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PART ONE
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WROUGHT IRON IN ARCHITECTURE

A REVIEW BY

MAXWELL RUTHERFURD

ALTHOUGH the present trend in architectural design and building has afforded an unprecedented increase in the number of new and improved materials, and although new methods and machinery have been introduced for using the older building materials advantageously, there has been a very marked tendency on the part of designers and craftsmen toward cheap imitation of one material by the use of another, both of which have definite inherent characteristics of beauty. The unfortunate part of such imitations is that in the attempt to make one material look like another it neither attains the beauty of the imitated material nor retains that which is naturally inherent in itself. Cement, terra cotta, or plaster may be and are very beautiful when used in such a way as to take full advantage of their plastic properties, but when in their use an attempt is made to simulate natural stone, the imitation is almost always so obvious and the result so forced and unnatural that from a standpoint of beauty the material has been wasted.

This practice of imitation and simulation has resulted, of course, in most cases, from an attempt on the part of the architect to produce an effect of extreme richness without the expenditure of the necessary amount of money. Clients are almost always anxious to achieve a rich and prosperous effect, but at the same time they demand that the cost be kept within strict limits, and the poor architect is driven to all sorts of expedients and subterfuges in the attempt to satisfy unreasonable demands. On the other hand, there are many instances where the imitation results from a surprising lack of knowledge on the part of the architect himself or of his designers and draftsmen as to the natural characteristics of a material or the way in which it should be used. Designs which are not based on a fair knowledge of the way in which a thing is to be made seldom attain real beauty, and they are likely to be extremely difficult and costly to make. Wrought iron is especially susceptible to this sort of treatment, since a great many people do not

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AND
Farmsteads *in* France

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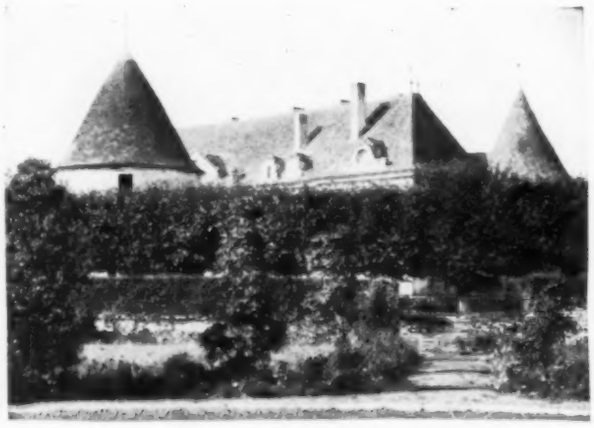

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IN all the wide search for architectural types in which to design and plan the American home, there has been found nothing more beautiful and appropriate than what is called "French Provincial," the term applying to the better order of farm houses, *manoirs*, and even to minor chateaux. It is a type full of graceful informality along with the touch of dignity or sophistication which renders it just a trifle formal; it is expressive of eighteenth century charm, and it suits admirably the needs of the present-day builders of suburban or country homes. In the refined and slightly reticent exteriors of the old French country houses, much emphasis is placed upon excellent architectural lines, while their interiors show carefully arranged and spacious rooms with well placed chimneypieces, doors and windows.

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properly appreciate the difference between wrought and cast iron or the peculiar qualities of form and texture that give wrought iron its rugged beauty. A draftsman will often prepare drawings for such a thing as a handrail having twisted bars for balusters and a delicately moulded rail, the balusters being as difficult to cast as is the rail to execute in wrought iron, and the whole will be labeled "wrought iron" and sent to the craftsman who, no matter how clever he may be, will not be able to do justice to himself or to his material. For a good understanding of wrought iron there is no substitute for a visit or a series of visits to a forge, and it would be even more helpful if the designer were able to actually take part in the working of the iron himself. In this way he would learn all the limitations and possibilities latent in the material and how to provide for properly using them in his designs. Familiarity with technical process is useful.

Wrought iron at the present time is experiencing a great deal of popularity. Many people are beginning to realize the great beauty and decorative possibilities of this material, which was so universally used in early times but which for many decades has, in a general way, fallen into disuse due to the greater economic advantages of cast iron. The recent era of prosperity and the undoubted rejuvenescence of good taste have created a demand for work in this medium which offers great opportunities to the architect who is equipped to make the best use of the material.

Wrought iron, being so completely the result of hand craftsmanship, the workers themselves must have great enthusiasm for their work and a considerable amount of artistic taste, so it is always well to select a good craftsman and entrust much of the detail to his good taste, since he knows the best way in which a design may be executed in iron much better than the majority of architects. Not only must he control the shapes and sizes of the different pieces and parts, but as a great deal of the beauty of wrought iron depends on the texture, he must use a good deal of common sense and good taste in working up the finished surface. Since the raw material of the forge is now usually purchased by the smiths in a great variety of regularly shaped stock bars, it is the custom of many smiths to produce the hand-hammered texture demanded by a great part of the public by beating the metal and deliberately disfiguring the surface. This method is not considered good practice unless the entire surface is covered, it being more desirable to start with a bar larger than the size desired and draw it down to the required size. In this way the natural wrought iron texture is attained, and the surface is made harder and more rust-resistant, it being an established fact that the more iron is worked under the hammer the more rust-resistant it becomes. It is always to the interest of the architect to select a highly skilled, artistic, conscientious craftsman to execute his designs, but often this is impossible due to the methods of open competition, and in such cases it is even more important that the architect have a good knowledge of smith work and be able to closely supervise the work of fabricating the iron. It is not absolutely necessary for the designer to know the name of every tool, but it is very desirable that he understand the use and function of the more important implements.

Another result of the lack of understanding on the part of those who design wrought iron is the unnecessarily high cost of ironwork, the design of which is more

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suited to cast than to wrought work. Many architects seem to expect a "smith to achieve in iron what a carpenter could attain in wood, a sculptor in stone, or a foundry in cast bronze,"—and at an equally low price. As in other branches of design, the pattern of wrought iron to be successful must be structural. The ironwork must be designed to serve a purpose, and the decorative members be so distributed and formed as to best serve the structural function of the article being designed. The practice of placing bits of so-called decorative ironwork on the facade of a building merely to relieve the blankness of a space should be generally condemned, and such unnecessary expedients as use of balcony rails set a bare 6 inches from a blank wall are one of the abominations of modern architecture. The work of early wrought iron workers owes much of its beauty to the facts that the blacksmiths were also the designers and that they worked with a very definite idea of making a useful object in the simplest and most direct manner. Wrought iron is essentially made up of a series of square, rounded or twisted bars with flat hammered plates, and any attempt to introduce other forms in a wrought iron design leads to unnatural and unsatisfactory appearance as well as to almost prohibitory expense.

As in other branches of art, wrought ironwork has taken certain definite forms and characteristics according to the various countries and periods in which it has been made, ranging from the severely simple cottage fixtures of England, France and the American colonies to the richly florid Baroque of the late Spanish and Italian Renaissance. Examples of all sorts may be found in the great cities of Europe, and it is unfortunate that the usual architectural traveler is too much preoccupied with his study of the more impressive features of the well known buildings to give proper study to the choice bits of ironwork to be found in the humbler dwellings.

Exhaustive treatises and collections of illustrations and drawings have been published on the subject in every land, but it has remained for Gerald K. Geerlings to compile the first really exhaustive work covering all countries and periods in a general way from the purely architectural point of view. In his volume "Wrought Iron in Architecture" he brings out very forcefully the realization that we are guilty of many shortcomings in our attempts to introduce wrought iron into modern American architecture, and he describes the processes, implements and materials of wrought iron working in such a way as to give the architect a good working knowledge of the subject and to enable him to approach the task of designing wrought iron in a really intelligent and efficient manner. The information gained from this book, supplemented by visits to the forges of good craftsmen, should lead to a great improvement in the quality of ironwork and show the way to designing it in such a manner that the cost will not be prohibitive, as has formerly frequently been the case. The description of wrought iron craftsmanship is especially valuable and interesting, as it brings out many facts which the author feels the designer should know in regard to the actual forging of ironwork, such as the properties of wrought iron and the best kind of raw iron to specify, the texture (legitimate and otherwise), and a fairly complete description of the wide variety of tools with which the smith is accustomed to do his work, and some description of the way in which each is used. The section on "Archi-

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tectural Design, Motifs and Ornamentation" will naturally be of great interest to the architectural reader, since it points out the design motifs best suited to ironwork and the forms which bring out its most important characteristics as well as giving some valuable pointers on some shapes that give an appearance of being very rich and costly while actually they are quite simple of manufacture and might be much more frequently used.

A few small marginal pen sketches illustrate some very useful tricks and forms to be employed in the making of wrought iron. The historical sketches which precede the illustrations of wrought iron of the various countries will be very useful in putting the designer in the proper frame of mind to approach the task of making designs from precedents afforded by the illustrations, which will in the fullest measure express the characteristics of the style and period in which the design is to be placed. Italian art of all kinds is among the finest in the world, and it is no more than is to be expected that the wrought iron of Italy presents splendid examples of the blacksmith's art. The cathedrals and chapels are especially rich in iron railings and grilles, and these together with balcony rails, standard holders and iron-studded doors furnish the subject for a wealth of photographic and measured drawing precedent. The wrought iron of Spain in many ways excels that of any other country, and it is perhaps true that Spanish architecture has depended more on wrought iron for its effect of richness than has that of any other country. The majority of Spanish wrought iron designs are so rich in decoration and detail and are so intricately wrought as to put them well nigh out of the realm of possibility for the modern architect to hope to employ them in his buildings, and yet for those who have the vision resulting from a true knowledge of craftsmanship, they offer great opportunity for restrained and beautiful adaptations in a more economical manner to suit modern needs.

The drawings and the illustrations of rich Spanish decoration in iron shown in the present volume, while in many cases rather bewildering in their mass of detail, will suggest to the discerning student of wrought iron many new possibilities in its simple manifestation.

According to many eminent authorities, the ironwork of France has been more uniformly good than that of any other country, and the work of the French craftsmen has had a strong influence on that of iron workers of all other countries. The ironwork of the English, German and Flemish smiths is also well illustrated and described, as is likewise that of America, the latter being divided into two sections, the first section treating wrought iron of the early period up to the twentieth century. The beautiful railings, grilles and balconies of such American cities as Philadelphia, Charleston and New Orleans are here shown in profusion, both by illustrations from good photographs and clearly presented measured details. The second section, on twentieth century wrought iron, is especially interesting, since it shows up-to-date tendencies as portrayed in the work of such master craftsmen as Samuel Yellin, Edgar Brandt and the Iron Craftsmen. Some space is devoted to special fixtures, and the final chapter deals with specifications.

WROUGHT IRON IN ARCHITECTURE. By Gerald K. Geerlings. 200 pp., 14 x 16 ins. Price $7.50. Charles Scribner's Sons, 597 Fifth Avenue, New York.

"CHURCH BUILDING"—*By Ralph Adams Cram*

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THE improvement which has accompanied the progress of American architecture during recent years has been no more marked in any department than in that of an ecclesiastical nature. This has been due primarily to the rise of a few architects who by travel and study have acquired much of the point of view from which worked the builders of the beautiful structures which during the fourteenth century and the fifteenth were being built over all of Europe.

These architects have closely studied the churches, chapels, convents and other similar buildings in England, France, Spain and elsewhere, and the result has been a number of American churches of an excellence so marked that they have influenced ecclesiastical architecture in general and have led a distinct advance toward a vastly better standard. This improvement has not been exclusively in the matter of design, for plans of older buildings have been adapted to present-day needs, and old forms have been applied to purposes which are wholly new.

THE appearance of a new and revised edition of a work which is by far the best in its field records this progress. Mr. Cram, being perhaps the leader among the architects who have led this advance, is himself the one individual best qualified to write regarding the betterment of ecclesiastical architecture. The editions of this work of 1900 and 1914, which have for some time been out of print, have now been considerably revised and much entirely new matter has been added, which in view of the change which has come over ecclesiastical building of every nature is both significant and helpful.

Illustrations used in this new edition of "Church Building" show the best of recent work—views of churches and chapels large and small, in town and country, buildings rich in material and design and others plain to the point of severity, with the sole ornament in the use of fine proportions and correct lines. Part of the work deals with the accessories of the churches and their worship.

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THE EDITOR'S FORUM

A PERSONAL MEMORY
HENRY FORBES BIGELOW, ARCHITECT

AT Beverly Farms, Mass., on August 12, 1929, Henry Forbes Bigelow ceased to be the center of a happy family life and passed from the circle of his friends. The first days with their somber sense of loss have passed, but fond memory will not pass while memory lives.

To one who knew him at work and at play, in wearied and in merriest moods, in the companionship of travel at home and abroad, there comes a desire to express a thought on his unpretending excellence. In recalling his varied activities, in his professional work, in public service and in his personal relationships, one is reminded of Newman's reflections on the attributes of a gentleman: "He is mainly occupied in merely removing the obstacles which hinder the free and unembarrassed action of those about him; . . . . he makes light of favors while he does them, and seems to be receiving when he is conferring. . . . He is never mean or little in his disputes, never takes unfair advantage, never mistakes personalities or sharp sayings for arguments, or insinuates evil which he dare not say out. He is patient, forbearing, and resigned on philosophical principles; he submits to pain, because it is inevitable, to bereavement, because it is irreparable, and to death, because it is his destiny."

"Harry" Bigelow was all of this. In the face of difficulties a valiant spirit furthered fine achievement, but trusted friends saw in him a personal modesty consistent with the youthfulness of his spirit. Of fine praise devoted to himself, we can hear him say, "Come now, nothing like that about me." It was this trait of mind in a person of rare ability that helped to make him rarer still. He left behind him good works and a heritage of affectionate memory.—Boston, September 20, 1929.

FRANK GOODWILLIE

WE regret to announce the death of Frank Goodwillie, A. I. A., on Monday, October 7, 1929, at Montclair, N. J. Mr. Goodwillie, who was a member of the New York Chapter of the A. I. A., and of the Architectural League of New York, had been in practice many years. Prior to 1922 he was in partnership with Frank E. Wallis, but since then and up to the time of his death he has been in partnership with William Edgar Moran. Mr. Goodwillie designed and planned many important structures, including the Manice Building in New York, the Globe Indemnity Co. Building in Newark, the Nela Park plant of the General Electric Co. in Cleveland, and numerous residences. During the World War he served under the Housing Bureau in charge of contracts; since then he has devoted much time to committee work in the American Institute of Architects.

A SERIES OF ONE-FIRM EXHIBITIONS

THE Exhibition Committee of the Architectural League of New York has decided to hold during the coming season a series of one-firm and one-man exhibitions at the Architectural League House, 115 East 40th Street, New York. The first of these exhibitions will include photographs and drawings of recent work of the well known Chicago architects, Holabird & Root. This exhibition will open on November 14 and continue through December 12. The names of the men or firms whose work will later be exhibited will be announced as soon as arrangements have been completed. The holding of this series of exhibitions marks a new departure in the policy of the Architectural League. Heretofore exhibitions of architecture and the allied arts have been confined to their annual shows which have been held either at the Grand Central Palace or at the galleries of the National Academy on West 57th Street. As in these large exhibitions it is possible to show only a few examples of the work of the architects or firms exhibiting, in many cases much splendid material is left out on account of lack of space. It therefore seems advisable to the Exhibition Committee to hold each season a series of exhibitions in the gallery at the League House, in which the recent work of one man or of one firm can be displayed more fully and completely than is ever possible at the annual exhibitions. Besides the work of prominent architects, the sculpture and the mural painting done by leaders in these fields of art will also be shown from time to time.

CONFERENCE ON CHURCH DESIGN

ON December 6 and 7, at the Statler Hotel, St. Louis, there will be held a conference on church architecture. The winners of the Christian Herald Second Annual Church Architectural Contest will be announced, and the Christian Herald exhibits for both 1928 and 1929 will be displayed. Some of the church bureaus will have displays of church architecture, and there will be manufacturers' displays. Among other subjects, will be treated and discussed: The modern church plan and design. Building for religious education. How far precedent should influence modern church design. How may the public be educated to demand better church architecture? How may architects promote a demand for better architecture on the part of local church building committees, etc.? The requirements for building for worship in American churches. Opportunity will be given for visiting the buildings of the Concordia Seminary and others.

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THE
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THE ARCHITECTURAL FORUM is published monthly by National Building Publications, Division of National Trade Journals, Inc., 521 Fifth Avenue, New York.

H. J. Redfield, Chairman of the Board and Treasurer; Howard Myers, President and General Manager; John Thomas Wilson, Vice President; James A. Rice, Vice President; C. Stanley Taylor, Vice President; Henry J. Brown, Jr., Secretary.

Yearly Subscription, Payable in Advance, U. S. A., Insular Possessions and Cuba, $7.00. Canada, $8.00. Foreign Countries in the Postal Union, $9.00. Single Copies: Quarterly Reference Numbers, $3.00; Regular Issues, $1.00. All Copies Mailed Flat. Trade Supplied by American News Company and its Branches.

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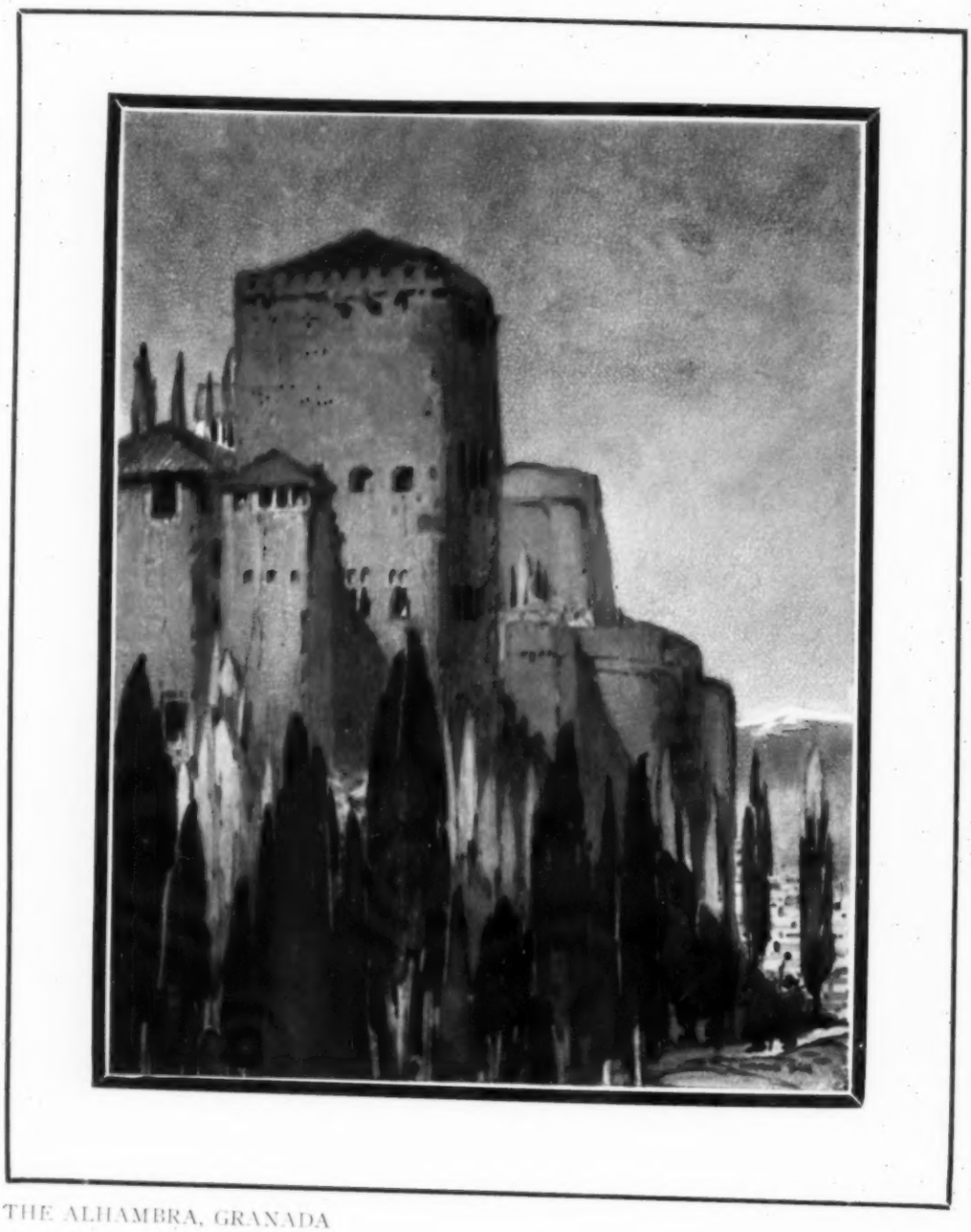


THE ALHAMBRA, GRANADA

From a Water Color by Carroll Bill

THE
ARCHITECTURAL
FORUM

VOLUME LI NUMBER FIVE

NOVEMBER 1929

A SPANISH HOLIDAY—I

BY

CARROLL BILL

ILLUSTRATED FROM WATER COLOR PAINTINGS BY THE AUTHOR

WHEN I told the editor of THE ARCHITECTURAL FORUM that I was sailing for Spain to see all I could, to paint what I could, likewise to eat and drink whatever came my fortunate way, in short to bring back in portable form as much Spanish atmosphere as could be absorbed in a short stay, he, without knowing what he was letting himself in for, said: "Write me a story about it, so you can go again," and falling readily for such allurement, I here presume to set forth a few of my richly jumbled impressions, architectural and otherwise, of a country at once so ancient and yet so modern; so grim, and then before you realize it, so amiable and smiling; so replete with the mellow architecture of many generations of men and her people, so much a part of and so closely allied to her soil, that one feels the sense of relationship between a wrinkled, old, rusty-cloaked peasant and the brown church against which he leans in the sun,—brothers, in fact, and inseparable. That is something of Spain. Espana, land of romantic story, land of strange contrasts, land of rugged form and color and fulfilling all else that we have heard so many times before; then add—a country now darkly gloomy with rock-rimmed desolate plains, fantastic architectural groups piled up against a background of great, high-tumbled cloud masses, drab and slate-colored; and now smiling in her spring green of newly growing fields and the gray of ancient olives, with far-flung reaches of burnt orange earth against snow-capped, cobalt mountains, her great open spaces dotted here and there with the red-brown huddle of a town gathering in about the base of its protecting church tower,—that again is Spain.

To so generously expose glimpses of her great storehouse of art and architecture that the ordinary traveler may with little trouble see and enjoy them, and then to shut away in a hidden corner some treasure of a town the discovery of which so well repays any hardship and adventure of the less frequented roads and uncertainties of Spanish travel by either train, auto or mule,—that too is Spain, and the numbering of her delightfully feminine inconsistencies might be continued indefinitely, to the exclusion of all else were not the main object of these pages to add a bit to the already ample store of Spanish architectural tradition and picturesqueness. And so to the road, which in this particular case began in New York harbor, for, under the red and yellow ensign of the Spanish Royal Mail Line, one steps immediately into the atmosphere of Spain, and after one derisive gesture in the general direction of our Statue of Liberty we went below to feast on *arroz Valencia*, fried devil fish, and the pleasant vintages of the country, both red and white. Ah, voyage of delightful memory and picturesque incident!—the stewards, like old family servants; the rippling Castilian speech in general use; the little deck hands, never without cigarettes, but polishing brass and stoning planks till the vessel shone like a yacht; the opening of what appeared to be a pair of bookcase doors to reveal a completely vested little altar served by the ship's *chapelin*; the 30 or more religious refugees from Mexico, taken on by the kind-hearted captain and given five meals a day, of which they took unfailing advantage; the retired American sea captain and his wife, on their way to a new home in Spain, and many Spanish commercial men, all interesting, the whole being much in the way of a good little appetizer for the rich banquet all laid and awaiting our landing.

After bucking head winds, high seas and rain for 14 days, the far-away sparkle of Cape St. Vincent and the Portuguese coast line told us that the voyage was nearly over; and as the misty rainy morning gave sight of blue and white Cadiz, the sun cracked the dull sky open, and we entered Spain under the arch of a magnificent rainbow, theatrical, perhaps, but true and typical of many happenings in store for us. Cadiz held us no longer than was necessary to establish liaison with the Spanish railway system and its very convenient form of kilometer tickets, and nightfall found us snugly housed in Jerez, an hour's

run from the seacoast that we were not to see again for a month. To give it its full-sounding, sonorous title, which I like very much, Jerez de la Frontera is a bright, cheerful town, prosperous to an unusual degree, thanks to its wine industry, about which, more later.

On arriving in any town, large or small, the established plan of procedure is to first find lodgings, bargain with the innkeeper, throw baggage inside the door, and then work out the shortest way to the cathedral. This plan is uniformly successful in establishing not only the location of the center of interest, which is almost always the cathedral, but also the general layout of the town, and in a short time it enabled me to acquire a good working knowledge of Jerez, aided, it is acknowledged, by an antiquated Baedeker of the year 1901. But Spain had changed so little that the old plans of streets and buildings were little altered from my memory of a previous trip, 15 years earlier. Jerez has the usual generous number of churches of a Spanish town, all interesting because all so different, and covering a span of several architectural periods. The best remembered are San Dionisio, a Gothic-Mudejar structure with great blank, grim walls and with a rose window at the very peak of its gable; the Colegiata, a Baroque edifice, with its towered facade and wide-flung buttresses, a curious combination of Gothic and Renaissance, approached by an intricate arrangement of ramping stairs; on each of the yellow stone finials of its lofty front was perched a black and white stork, whose ragged feathers blew in the wind, for all the world like the hair and beards of old men; San Miguel, with its handsome blue, white and yellow tiled tower, and San Francisco, yellow as gold in the afternoon light; and, planting myself in artistic rather than religious adoration, I began my first Spanish sketch.

The original intention as to painting was to make finished water colors on the spot, but my initial experience in Jerez changed all that, and I had been at work but a scant five minutes when I was surrounded by a crowd of perhaps a hundred spectators, not malicious or troublesome, but so childishly curious and eager to see what the folding stool and trick easel and little tubes of color were all about and what sort of entertainment I was to provide for them, that they made impossible anything but the most impressionistic handling of the subject. Speaking, as I did, a little Spanish, it was possible to hold them within reasonable bounds; but my wife, good companion on my journeys, also sketching and by nature conversationally adept, was, in this emergency, reduced to the silent acceptance of all that the crowding onlookers chose to offer and was, on one occasion in Jerez, politely but firmly escorted to the nearest police station for blocking traffic.

Architecturally, and paradoxically speaking, the chief item of interest is not in Jerez at all but three kilometers away over the dusty road to the southeast, where in its mellow and deserted isolation lies the Cartuja, a Carthusian convent founded in 1477. The first impression is of a great and elaborate Renaissance facade completely isolated from the rest of the group of buildings, a huge towering gateway, in fact, through which we pass into a stone-paved, grass-grown court, once the nave, but now open to the sky, with side walls tumbled to heaps of rubbish. At its far end is another facade of the same yellow stone with coupled columns piling up to support and enframe figure-filled niches and broken cornices, all soaring to a central composition of rose window, arch and crowning structure, and the whole profile enlivened by curious and elaborate urn-shaped pinnacles and balustrades. Keeping in mind this last word in late Renaissance, we thread a series of passages and courts into one of the largest and finest Gothic cloisters in Spain. This architectural contrast or association of two or more distinctly different styles is to be met constantly throughout the land, and strangely enough it is not as disturbing as it might seem, for the Renaissance has a Spanish flavor all its own, as has also the Gothic, and the two seem to dwell in intimacy peaceably enough. Picture to yourself a great cloister, 500 feet square, completely arcaded and buttressed, with its upper structure housing in its high day a thousand monks; in the center a stone basin, in which might swim a dozen swans, with a fountain in the middle of the pool, and above all the lofty yellow mass of the main church showing through the black-green of ancient cypress. While in a lamentable state of neglect and ruin, it was a joy to learn that the Cartuja had been taken over as a national monument, and in one corner a tiny group of human ants had already started their mighty task of restoration. Perhaps because it was our first important architectural discovery after landing in Spain, and because we came so unexpectedly across such a tremendous pile of yellow sculptured stone in its sleepy isolation, the Cartuja made a mental impression that endured throughout all our sojourn in the country.

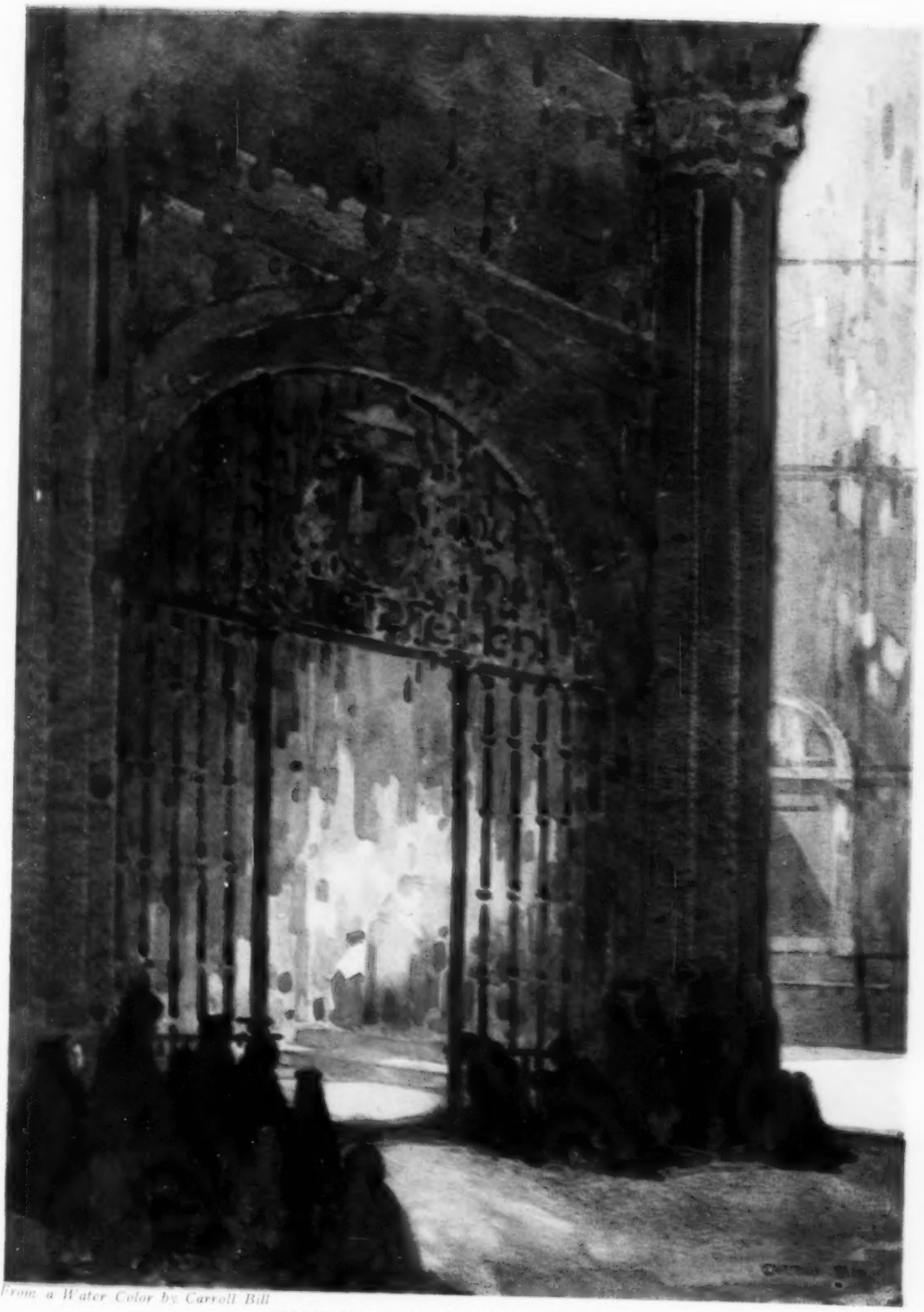
And now, speaking not at all in reference to architecture, the most delectable phase of life in Jerez centers about a certain time-honored and traditional industry which owes its existence to the enormous vineyards surrounding the town on every side and through which the road leads back from the Cartuja. Now be it known that from these same vineyards, made up of what as far as I could see were acres of dry dust, stuck all over at regular intervals with gnarled stumps and most

From a Water Color by Carroll Bill

CHURCH OF SAN FRANCISCO, JEREZ DE LA FRONTERA

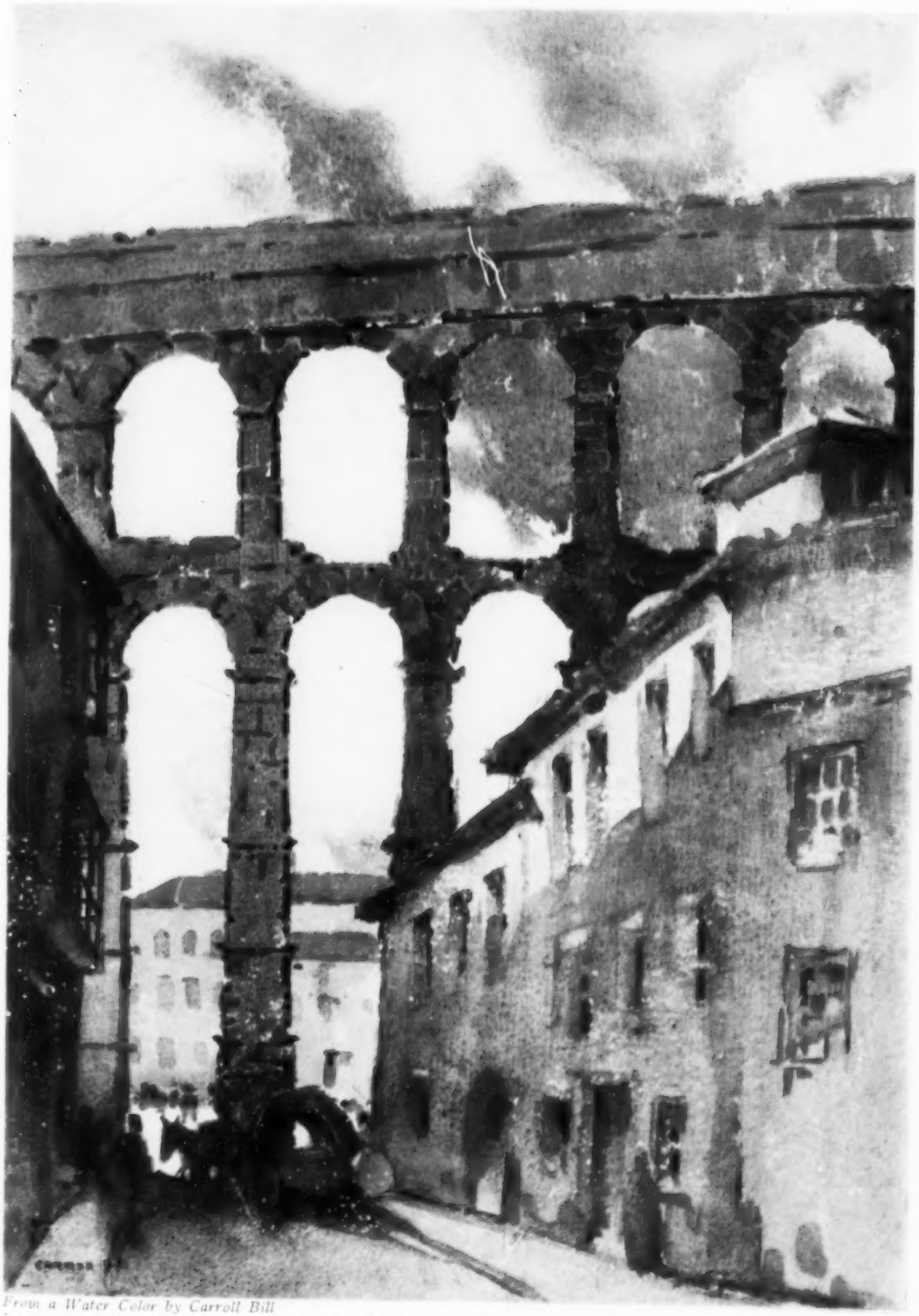
From a Water Color by Carroll Bill

CONVENT OUTSIDE THE WALLS, AVILA



From a Water Color by Carroll Bill

CHAPEL IN CATHEDRAL, SEVILLE



From a Water Color by Carroll Bill

THE ROMAN AQUEDUCT, SEGOVIA

unpromising looking twigs from each of which had been trimmed all signs of life save one solitary green sprout, there ripen in due season the grapes from which for generations of men have been gathered, nursed, educated and matured the luscious vintages known to the civilized world as sherry. Shakespeare's England knew it, and old Falstaff tells of "sherris sack from whence comes valor," and down through Georgian times every sporting baronet let no year pass without having his casks built one within another to prevent theft of the precious contents coming over the channel from Cadiz harbor, and no cellar worthy of the name was without its butt of Oloroso. My emotions, olfactory, gustatory and spiritual, were raised to their highest when invited to visit the great *bodegas* of Pedro Domecq in Jerez. It was an invitation easy of acceptance, and after being shown through warehouses and storesheds, cathedral-high in size, piled ten deep with casks in various stages of development and whose removal from their fragrant surroundings is permitted only after 30 years of faithful attendance, we were reverently conducted and ceremoniously introduced to certain mouldy tuns, some of which had reached the serviceable age of 200 years and bore the arms of George III, William Pitt, the Duke of Wellington and the like, and were invited to sample their fragrant contents. The present royal house of Spain was represented, and Alphonso and his queen had their casks gaily hung with the colors in recognition of a recent visit. The ultimate hospitality of this fine establishment, as extended to us by its gracious younger son, took the form of a parting gift of two bottles of the famous Oloroso, dated 1840!

Fearing that, after such a soul-satisfying experience, which comes to the ordinary mortal but once in a lifetime, but which I cherish hopes of repeating within the year, any other possibility of Jerez would prove but an anticlimax, we took the road to Seville and in a murky drizzle, not at all typical of southern Spain, we clattered over stone pavements and around amazing corners in search of a certain sixteenth century palace, now in this later and more prosaic day devoted to the sheltering of just such travel-worn and none too particular seekers of the picturesque as were then knocking at its battered portal. Bowed in by the whiskered Don Marcos, we were shown a room on the ground floor which must in the early days have been a lounging place for the menials of the house and in which were four doubtful looking beds and a damp chill for a coverlet. Protests finally availed, and crossing a great patio open to the sky and up a staircase 15 feet wide, we were very pleasantly lodged in an enormously high-ceilinged room with great wooden window shutters, tile floor and two electric lights, only one of which could be lighted at one time, a thrifty bit of electric wiring that, with experience, was found to be universal throughout Spain.

Seville, always smiling, but now wearing an air of newly acquired prosperity, had taken to herself a different and rather disturbing atmosphere. Always gay and very feminine, she had blossomed out in a dozen different ways,—old streets pulled apart; new streets cut through, with smart-looking shops with Frenchy looking clothes in their windows; a traffic problem all her own, due to the crush of automobiles, mostly American, from those of a well known make up to luxurious limousines; all this rather unpleasant on the whole, until we put ourselves in a state of mind to accept all this modernity as a foil to emphasize the dignity of the archbishop's palace, the sparkling stateliness of the *Ayuntamiento,* and the fine soaring shaft of the *Giralda,* lifting its aristocratic self far above the modern tangle in the streets at its feet. To me Seville is personified in its cathedral. In contrast to the masculine vigor of the cathedrals of northern Spain it has a lightness, an almost feminine gaiety in its tangle of pinnacles and buttresses. There is no facade, as such, but a great wall seeming to enclose the church and opening out on one side to make room for the cheerful Court of Oranges with its fountain, where come the women for water. All this so disguises the plan that one can form no definite conception of the interior arrangement, and it is only when one enters that there comes the full realization of the wonder and immensity that man has here created. I hope that the visitor will have his first impression as did I, late in the afternoon, when the sun had left the lower church in mellow gloom with here and there a candle-lighted chapel glowing in the dusk and the intricate detail of the high altar and its soaring *retablo* catching the light from the amethyst, ruby and orange glass of the clerestory windows. I am not attempting any detailed description of Seville or any other cathedral. One can, if one wishes, find it handled by many different minds from many different viewpoints,—John Lomas, for instance, Maud Howe, or even that emotional Italian, Edmundo de Amicis, who confesses that he cannot even think of Seville Cathedral without his throat swelling to dangerous proportions, and so to avoid any such calamity, I am risking the wrath of most lovers of Spain by claiming that the Alcazar of Seville can give all and more of Arab detail, color and feeling than can the much-vaunted Alhambra at Granada.

Perhaps I am prejudiced against Granada by painful recollections of the nine-hour railroad journey, the sordid modern lower town, the failure to find lodgings in the pleasant place where I had lived 15 years ago, and the whitewashed,

dusted-up interior of the Arab palace itself, and the reader must pardon this, my one and only period of disappointment of the whole trip. And even the Granada detour had its bright spots, for from the train there passed in stately review the lofty ranges of the Sierra Nevada, its gray-green foothills banded with raw red earth, warm purple slopes and ultramarine peaks snowcapped against a tumble of white clouds, and the great red Alhambra and the little *Generaliffe* snuggled in cypress groves and ilex thickets; all charming, but to repeat, one might well remain in Seville and enjoy at the Alcazar a feast of beautiful arches, walls patterned with marvelous tiles, mosaics and sculpture, fountain courts and gorgeous colored and gilded ceilings; and further controversy as to the comparative superiority of the Arab remains of Seville and Granada may best be avoided by walking out on the bridge of Triana, and if it be at the end of the day, the passing crowd is as entertaining and colorful as a well staged play, set against the background of the Guadalquivir with its shipping and docks.

The patient oxen, single or paired, with red wool headgear hanging over their eyes, draw enormous loads with a slow, heaving lurch, and little gray donkeys with big frowsy heads look out from under burdens so out of scale with the small beasts as to suggest huge piles of fagots trotting along on very diminutive legs. Abused and overloaded as the Spanish donkey seems to be, it was finally decided that he was not to be pitied so much after all, for he is the absolute personification of utter resignation to fate, and one typical case of kindness was when a small brown donkey was slowly fed a long hot dough fritter by the master who towered well over the small back on which he had been riding for many miles. And what an amazing variety of articles are piled on these little beasts! Great bags of clay going to the potters to be spun on the wheels that have been turning for three centuries, and to return in the form of water jars, great basins and the rest of the pottery that has made Triana famous even outside of Spain; huge tin water cans polished to the gray luster of pewter; piles of olive branches destined for the charcoal burners rather than the proverbial peacemakers; odd pieces of furniture; white meal sacks; the colorful *alforjas* or saddle bags; and as often as not a human burden, lounging cross saddle or with legs dangling to the ground, smoking the usual cigarette, and both beast and rider ambling along totally indifferent to the rest of the traffic. And if we stay a bit longer on the bridge, we will see groups of cigarette girls home bound from the tobacco factory; brown cloaked, red capped soldiers back from the Riff war; a bearded Franciscan; a *guapo* or bravo with colored sash and broad-brimmed hat; and his traditional enemy, the *guardia civale*, brave in his gray and yellow tunic and shiny black headgear.

As far as limited time and the chances of the road permitted, it was our intention to see something of the smaller and less frequented towns, and the first step away was to Utrera, a jolly little place an hour's run from Seville. If our reception by the inhabitants was any indication, we must have been the first of our kind to invade its steep and narrow streets. The opening of a camera was enough to block traffic, and our progress was one long procession in which we were the distinguished leaders; it was only by finally ducking through a doorway and shutting the gate that we rid ourselves of our followers and took possession of a very lovely garden, where we were made welcome by its gracious owner. We sat under the flowering lemon trees and sketched, first the great square tower of Santa Maria de la Mesa, and then the beautiful plaster structure over the well in the center of the garden, and we would have been content to spend there the rest of the day but for the lure of further adventure.

The Spanish children who are so much in evidence in these informal gatherings are for the most part happy, pretty little people and enjoyable enough except when they cough down your neck in their eagerness to see your sketch. I never found them malicious, but just bubbling with an easily understood curiosity, and I recall with delight being accompanied by a dozen little boys and girls all, to be sure, spurred on by the hope of a copper reward, uphill and down on a long tramp outside Granada; and when I at last reached my objective and reclined in the shade of an ancient cypress, these little imps, none of them over ten years old, did for me on impulse a wild dance with wriggles, twists, snapping of fingers and all the grown-up mannerisms of the gypsy tradition.

If for no other reason, I place Utrera well in the fore of Spanish towns on account of its cleanliness. Whether this unusual condition were due to the heavy spring rains (of which in a 40-day stay we had 17), or to the industry of its people, it matters not; but white it was, bright and sparkling, and with its main square closed in with snowy house fronts, whose many balconies held pots of scarlet flowers, it was a joy. Not that cleanliness or the lack of it makes one particle of difference to me when weighed in the balance with picturesqueness, and I have no patience with the returned tourist whose only comment on some charming old town is that his sensitive nose was assailed by aggressive odors and that his eyes were forced to view unpleasant sights, which entirely overpowered his appreciation of the often surprising beauties of the place.

THE SPIRIT OF MODERN ART

BY

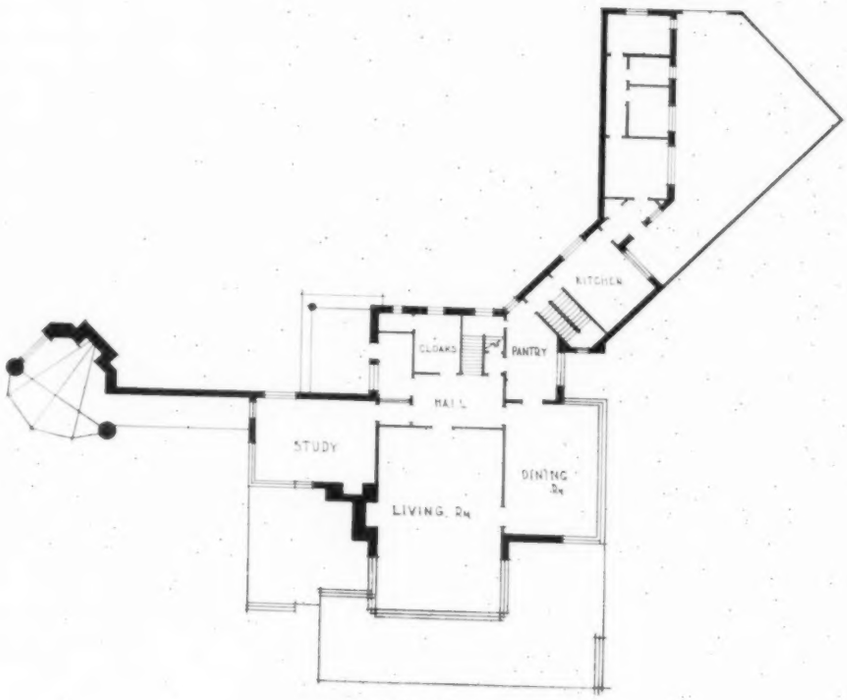
RAYMOND M. HOOD

THERE is no need to tell anyone that art has "gone modern," but very few people know what "going modern" really means. The common conception is that it means a radical change in the looks of things, that the time has arrived when precedent and the accepted standards of beauty are all to be thrown overboard, and that with a new philosophy as a base, new standards and wholly new conceptions of beauty are to be manufactured. Nothing could be further from the truth. The modern movement does not concern itself with looks at all. It does not care whether we abandon or follow precedent, nor is it interested as to whether the new rules of art are derived from the machine, nor even whether there are to be any rules at all. This misconception is the result of the shallow propaganda of the art critics and the dilettante magazines, as well as because of the stupid exploitation by those who traffic in art. For there is in the new movement such a value, both as news and otherwise, that nobody in the business of exploiting art has made any attempt to dig beneath the surface to find out what modern art really is. They have merely dished out what they found on top, made a grand living out of it, and let it go at that.

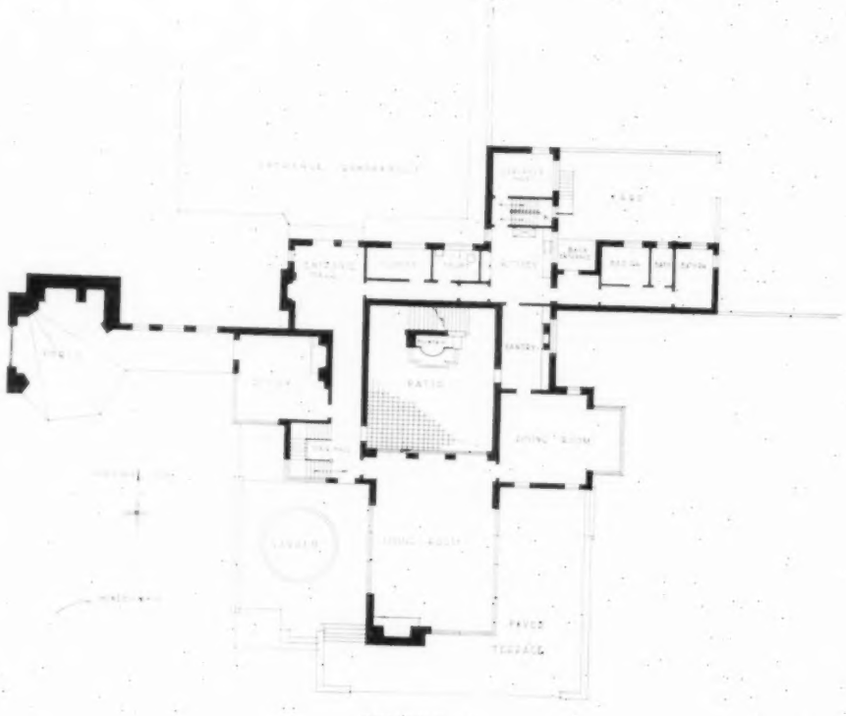
There is a general idea that after a certain length of time a style of art must be changed, merely because it has become monotonous, and because people tire of one aspect of things. Minor changes and fashions of the moment may be explained that way, but the reason for great changes, such as the development of Greek or Gothic art, lies much deeper than that. And the movement that is going on today transcends in importance even movements of those epochs, great as they were. I doubt if a new era of art has ever developed where a desire for a change of appearance, or a change for the sake of a change, had less to do with it than is the case today. If anything, it is safe to say that people had never been more content with the looks of things than they were just prior to the time when the modern movement began to take form. Certainly the antique business bore witness to this fact. Patronizing art was a comfortable and easy pastime. The rules were well formulated, and with the authority of centuries behind them, they were generally accepted. Standards were so well established that beauty could be determined almost by rule of thumb, and a certified work of art had a value as sound as a government bond. There was nothing disconcerting in the business for either the artist, the merchant or the buyer. Everybody was happy as far as looks and beauty were concerned, yet it was at this very time when art and beauty were so comfortably organized, so apparently secure in their hold on the imagination of people, that the modern movement began to force itself upon us.

The truth is that, way down deep, art was really in a bad way. For centuries the romantic sentimentalist and the artistic genius, with his capacity for giving infinite pain, had been in the saddle. They held a tight rein, and their authority was bolstered up by everything that was called culture and tradition. Art had become a smug, fashionable game in which the world was the victim, for while the world paid the bill, the artist took nothing seriously save himself. He might be commissioned to create something to achieve a certain purpose, or to express a particular idea, but from his point of view the only purpose to be achieved was the perpetuation of his own brand of beauty, and the only thing to be expressed was his own soul. Creative work might be stimulated and paid for by others, but for him it was only an opportunity to express himself and his cult and to achieve immortality. Humbly doing the business that was set before him to do was not in his code of ethics. A timid remonstrance that a table was not suited to its purpose or that it was rickety, elicited a scornful reply that if this slight sacrifice could not be made to beauty, it would be better not to have a table at all. A person brave enough to insist on an article's being useful got in return a contemptuous toss of the head and was promptly put back in his place along with the other low-brows. The public was bullied, browbeaten and buried beneath an avalanche of historical reminders about the Greeks, the Medici, and men of the other golden ages when people lived, suffered and died for beauty.

A mechanic would make a comfortable chair, and a designer would calmly ruin it in the interest of art. A railroad company would try to build a station, and its architect would blandly set aside one after another of the practical elements that had been worked out, because they prevented his developing in the building his theory of composition and beauty. The chair designer would not permit the chair manufacturer to make a good chair, neither would the architect permit the railroad company to build a good station. The mentality of the designer, at times, was so far twisted that the chair must be built to satisfy Mr. Hepplewhite, and the station Tiberius Cæsar, in spite of the fact that both have been dead for a long while, and neither of them would either pay for or use

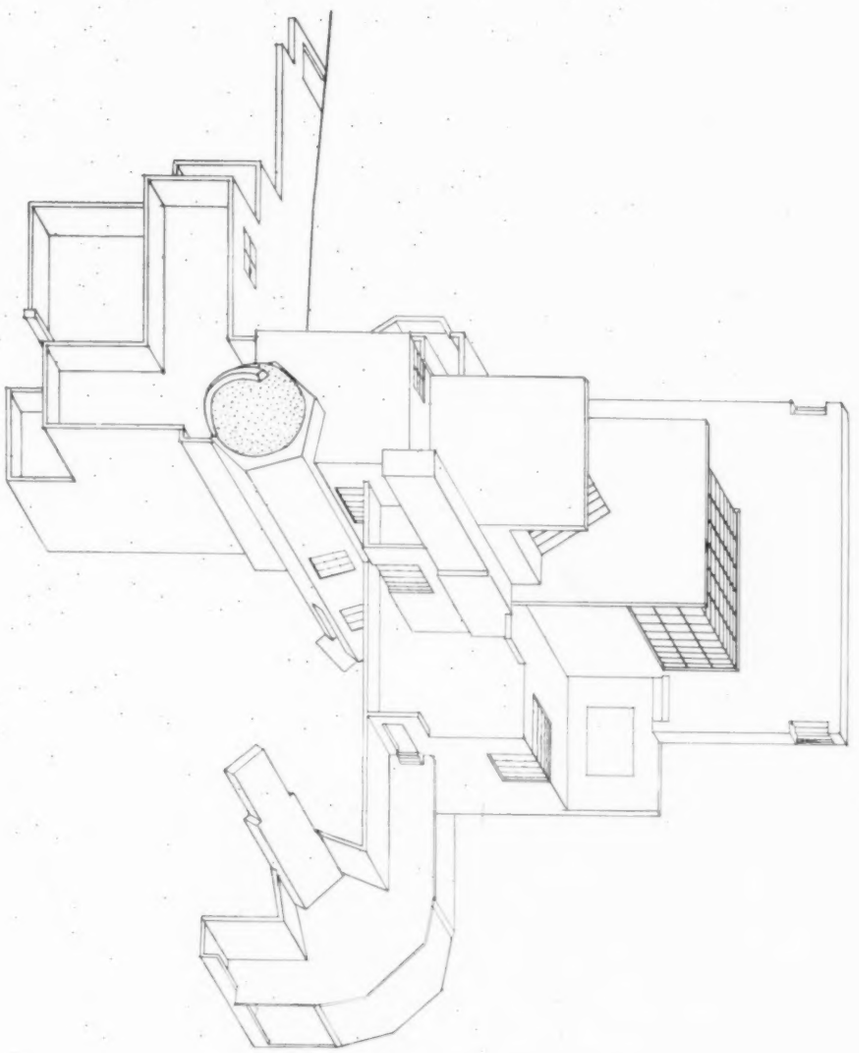


SCHEME W

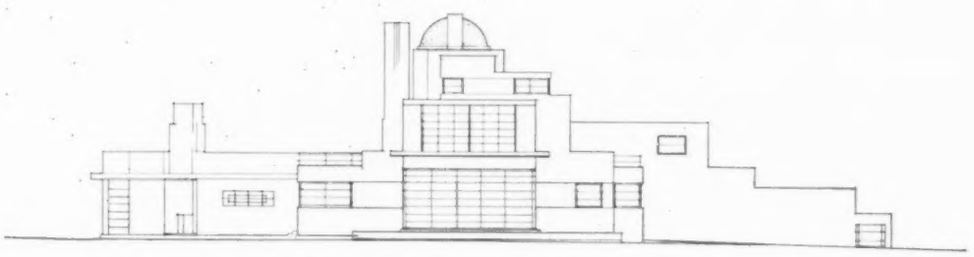


SCHEME X

TWO PLANS FOR A MODERN HOUSE
JOHN M. HOWELLS AND RAYMOND M. HOOD, ARCHITECTS



BIRD'S-EYE PERSPECTIVE, SCHEME W



SOUTH ELEVATION OF SCHEME W

DESIGN FOR A MODERN HOUSE

JOHN M. HOWELLS AND RAYMOND M. HOOD, ARCHITECTS

the object that had been designed to suit him.

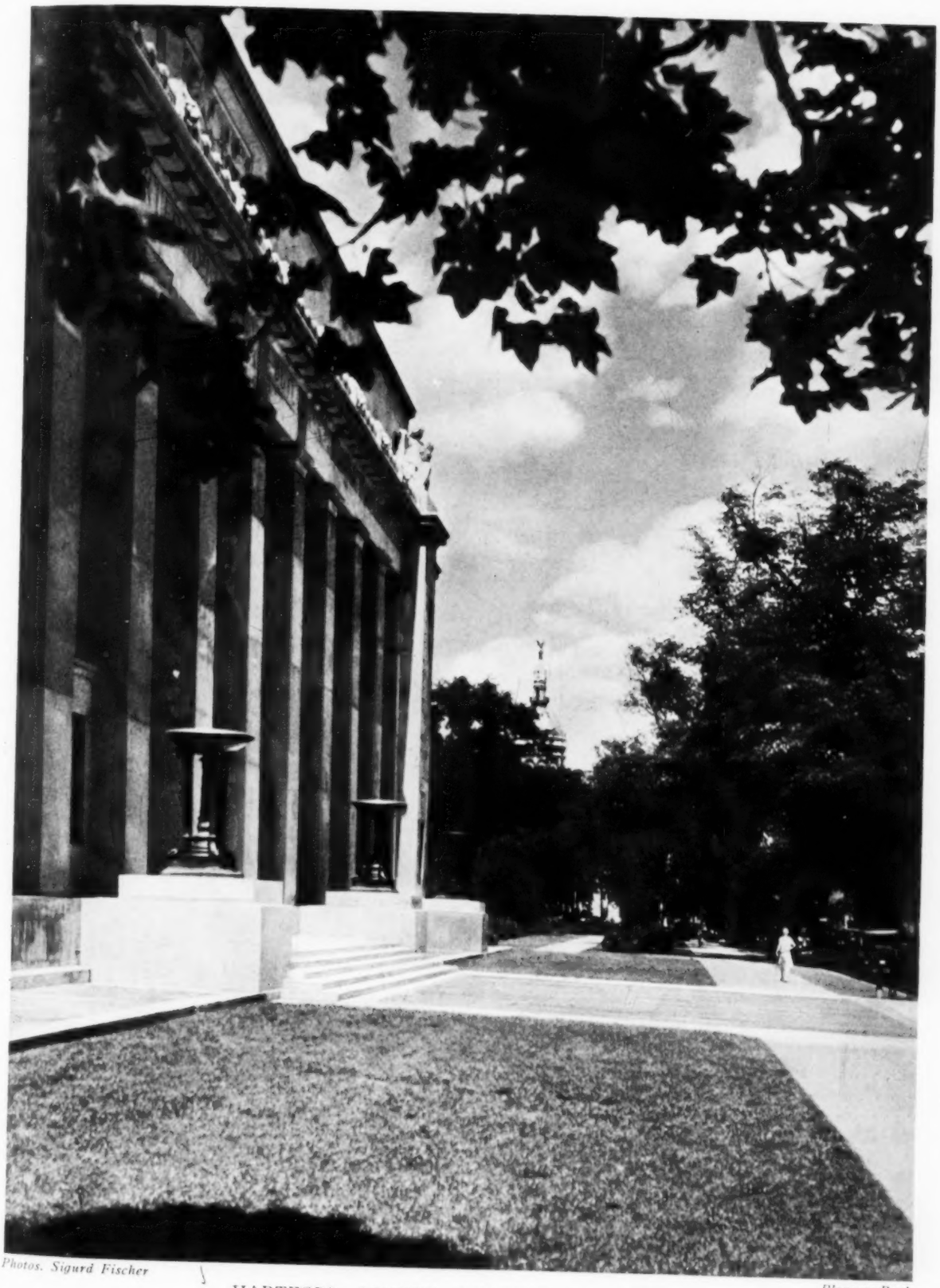
To take an example from my own profession, the architect might tell you that the symmetry, the balance of a composition, or the character of the exterior would prevent your having a room of the size and character you required. He might even prevent your putting windows and doors in the places they should go for the comfort of living, for similar æsthetic reasons. In fact, art had become a hard master, and yet in spite of its pretentiousness, it was really shallow. It concerned itself only with externals,—how it impressed people,—and it paid little heed to what went on underneath. It was like a man who insists on being perfectly dressed and on having perfect manners, but who pays no attention to his character.

It is against this despotic sway that modern art has risen in revolt, and it is not because the old rules of composition, color harmony, unity and so on must go by the board. The artist or critic who tells you that tempo, rhythm, dynamic symmetry, color discordance, motion, pattern, or the inspiration of the machine are the basic qualities of the new art, is passing out the same old hypocrisies that the new art is trying to overcome. These qualities may occur in modern art, but they are incidental and not essential to it. Modern art involves a sincere attempt to be honest. If a man asks for a fork, he isn't offered a spoon. If he wants a work bench, he isn't given an Italian altar piece. If the glare of a light hurts his eyes, he is not told that his eyes are wrong; the fixture is re-designed. A door is a door, something to walk through, something to open and shut, not a recall of a dominant motif in a facade, nor the expression of some æsthetic emotion. And the same spirit, the same effort, is the basis of all modern design, from that of the pen holder up to that of the great skyscraper. We try to be honest and give a man, his ideas and his money an even break.

To put the case briefly, the modernist is trying to "debunk" art. He reverses the common philosophy of the past centuries, when the manner of doing a thing, its form and appearance had become more important than the thing itself, when the iron-clad rules of art and beauty came first and utility trailed along as best it could. Today utility leads the way, and although the result may not always send emotional shivers of beauty up the spine, it offers a good substitute in that it satisfies the intellect. The practical elements of a problem are solved before our old friends,—art and beauty,—are given a crack at it. So, if chromium is used in modern work, it is not because it is the fashionable metal of the new period, but because it is more practical, cleaner and requires less care than other metals in the same place. When plain surfaces and color decorations take the place of elaborately modeled forms and ornament, it is not because simplicity and color constitute the keynote of modern art, but because to produce the elaboration and ornament of the older styles required an effort and cost far out of all proportion to the importance of decoration, and because the article is more serviceable when done in a simpler fashion. That appearance of things has changed is inevitable, for in his search for truth and honesty, the designer of today must avail himself of every new material and process that is superior to the old. And in so doing, the inherent qualities in the new materials and processes that he uses force a new external expression.

I need hardly point out that the new movement has freed the spirit not only of the designer, but of the world at large. Art is no longer cloistered religion, shrouded in mystery in order to better keep up its authority. We do not have to stand in awe of it lest we be outcasts from the world of culture. We need not fear when we ask for bread that the artist will give us a stone. We ask for what we need and we get it,—and, strange to say, the artist now tells us that this is the only true path that leads to beauty—and that real beauty is only achieved when utility is the goal. For ages we have been searching frantically all over the world for the path to beauty, and now we have come to find that the path lay at our feet all the time, and that common sense and logic will keep us in it if we will only accept and use it.

I am far from saying that all the artists who have "gone modern" have turned away from the hypocrisy and cant of the periods gone by, and that those who haven't are still sunk in sin. Many who have adopted the external trappings, the color, decorations and details of modernism are far less modern than others whose work may still bear an external resemblance to that of older periods, but whose conception is fundamentally modern. In fact the same fellows who were hypocritical and dishonest in their art yesterday, are hypocritical and dishonest in their art today, no matter how they may be classified in the public mind. The sincere artists through all ages have worked as honestly as the sincere modernist is working today. The only difference is that now he can come out into the light, without fear, for at last he has the weight of opinion and culture at his back. The man in the saddle today is the artist who wants to help and not to clutter up the path of progress. The man who says "It can't be done, because it wouldn't be beautiful," is supplanted by the man who says "Of course it can be done." It is the beginning of a great era for the world, as well as for the worker in all fields of art.

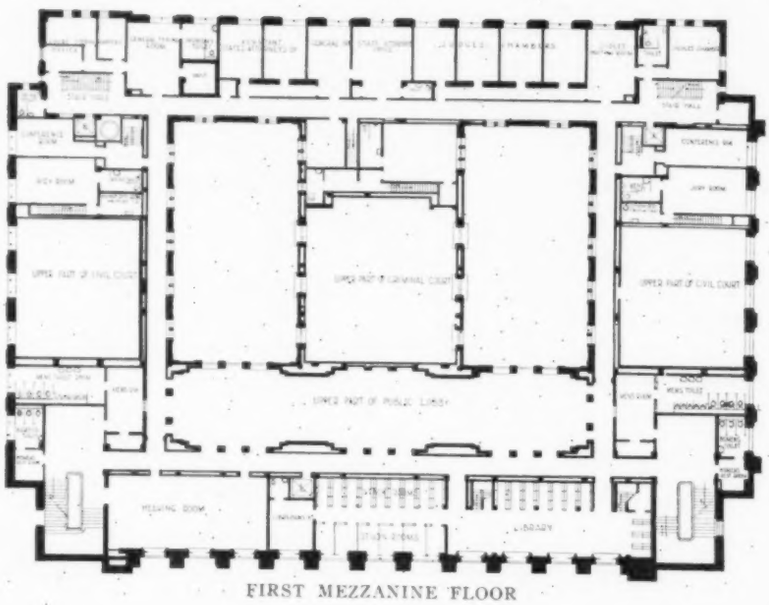


Photos. Sigurd Fischer

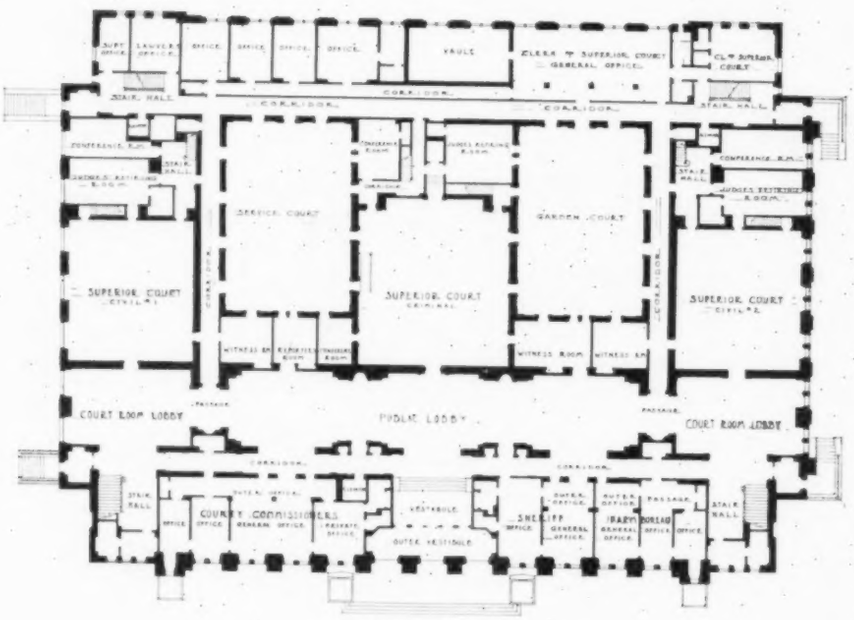
HARTFORD COUNTY BUILDING, HARTFORD

PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS

Plans on Back

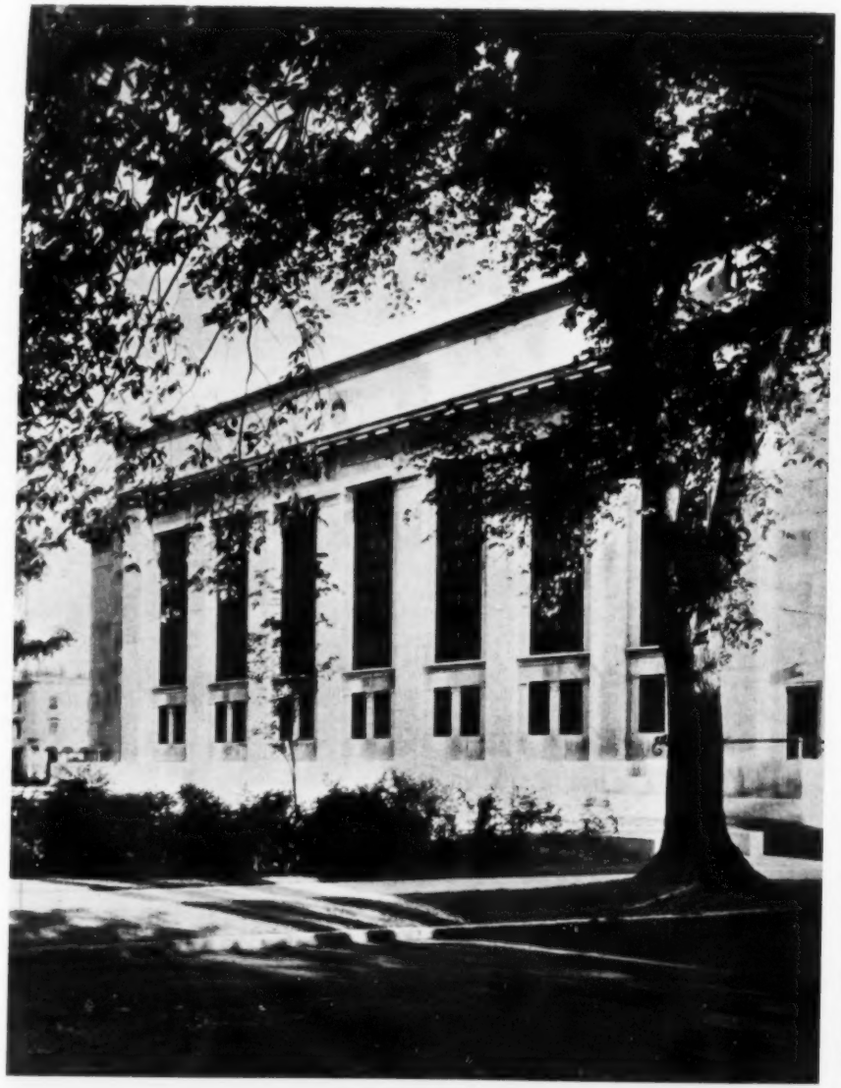


FIRST MEZZANINE FLOOR

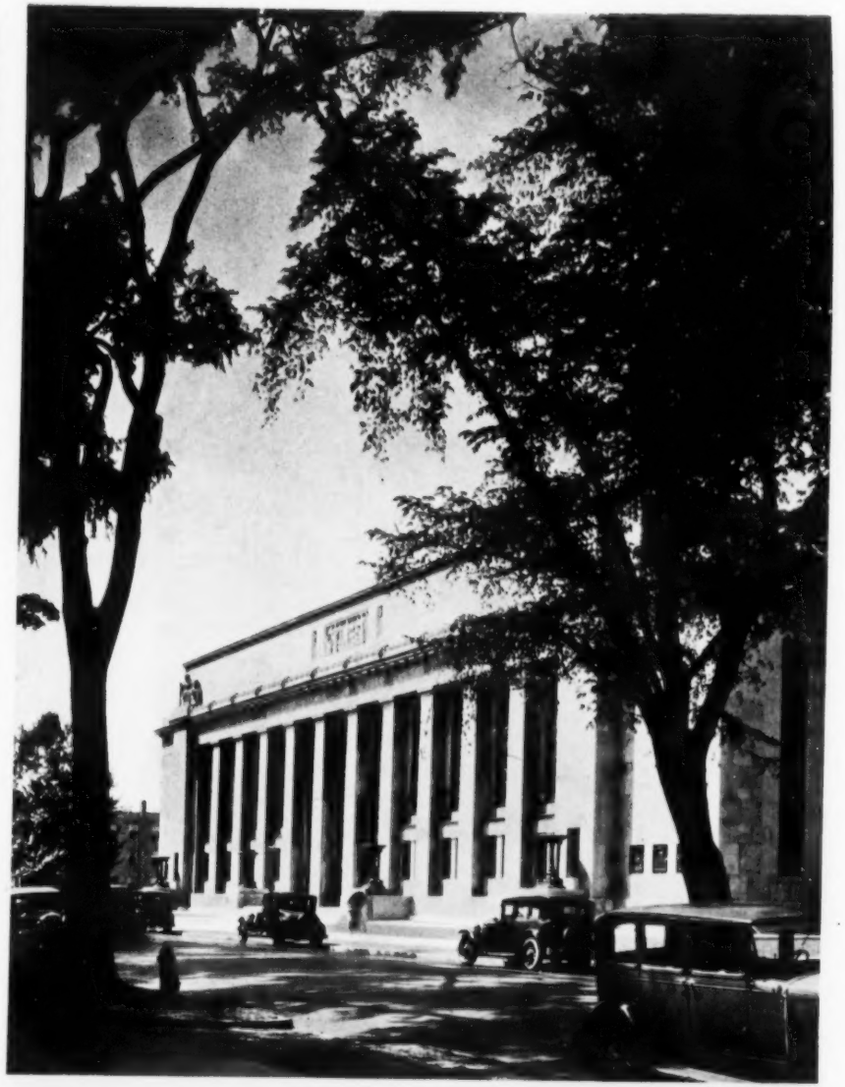


FIRST FLOOR

PLANS. HARTFORD COUNTY BUILDING, HARTFORD
PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS



NORTH ELEVATION

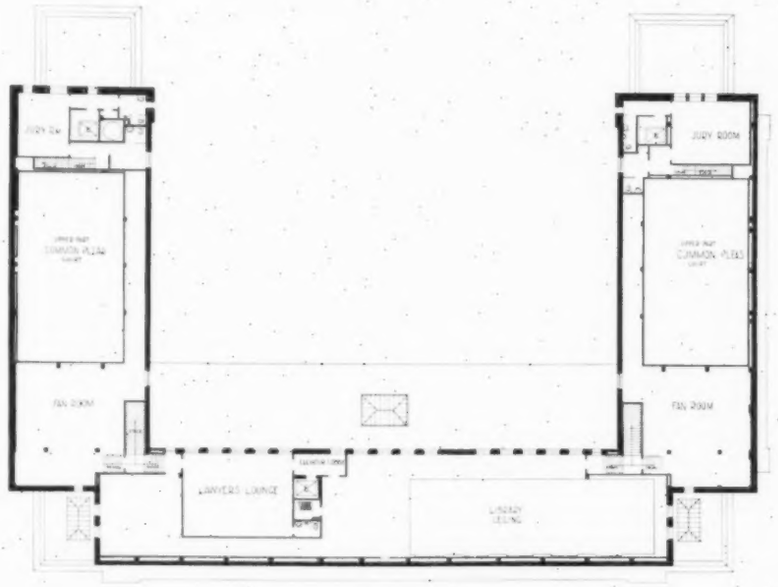


FRONT ELEVATION

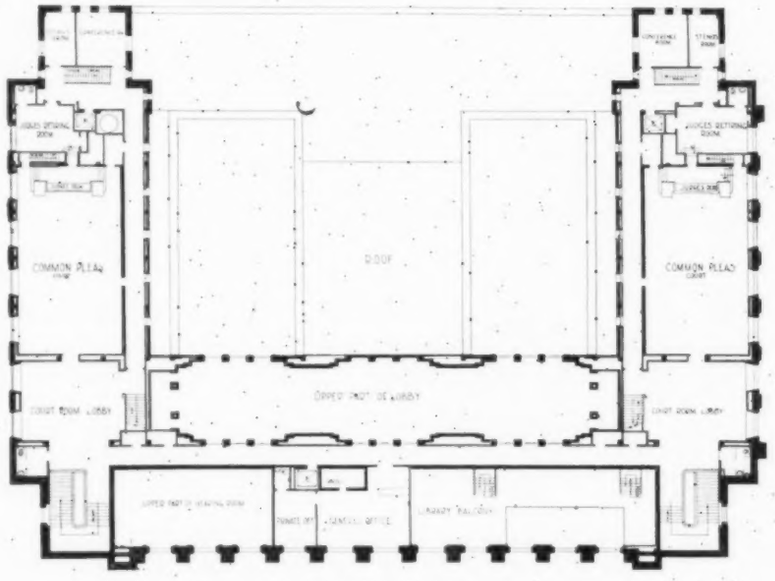
HARTFORD COUNTY BUILDING, HARTFORD

PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS

Plans on Back



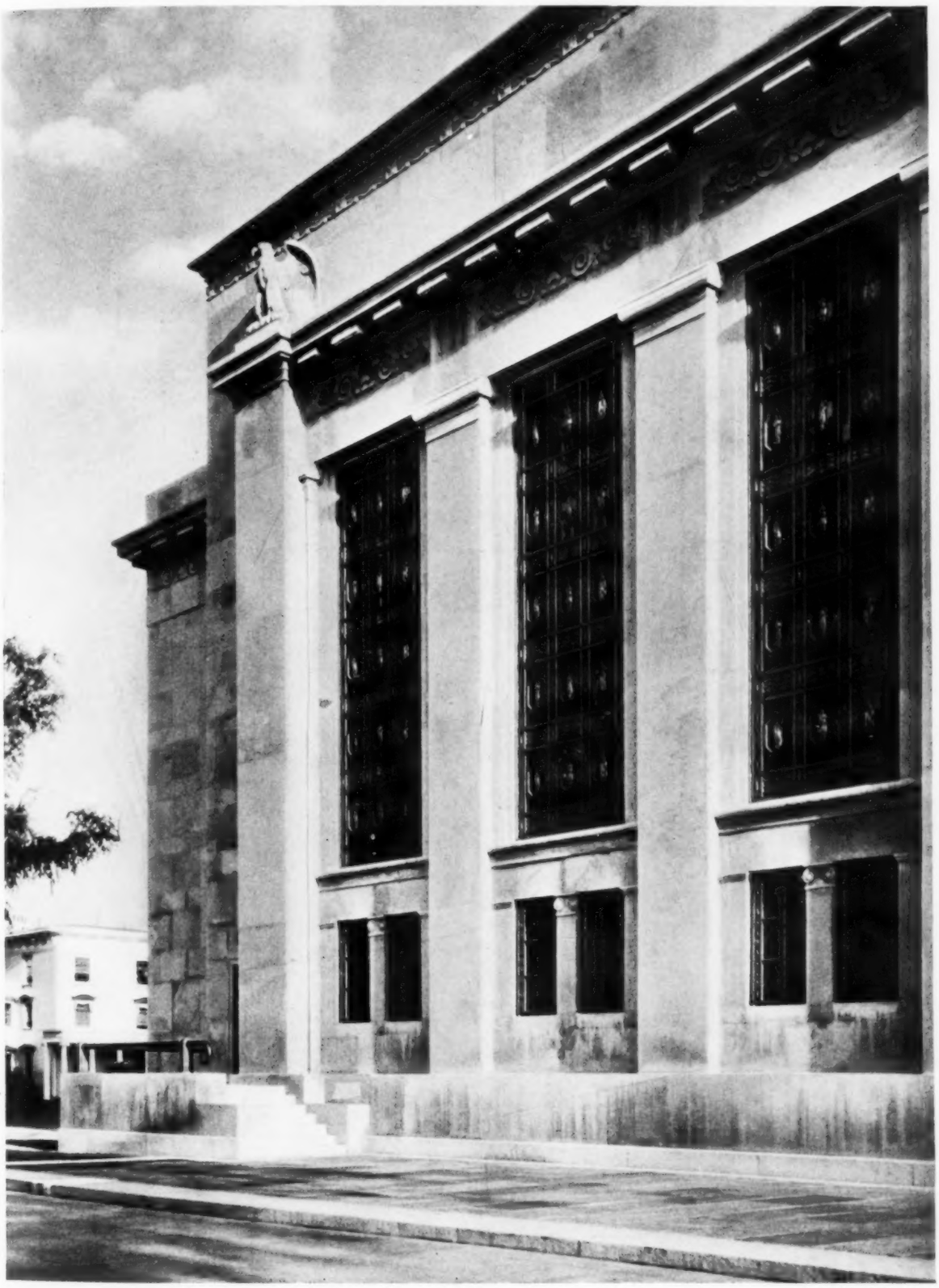
THIRD FLOOR



SECOND FLOOR

PLANS. HARTFORD COUNTY BUILDING, HARTFORD

PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS

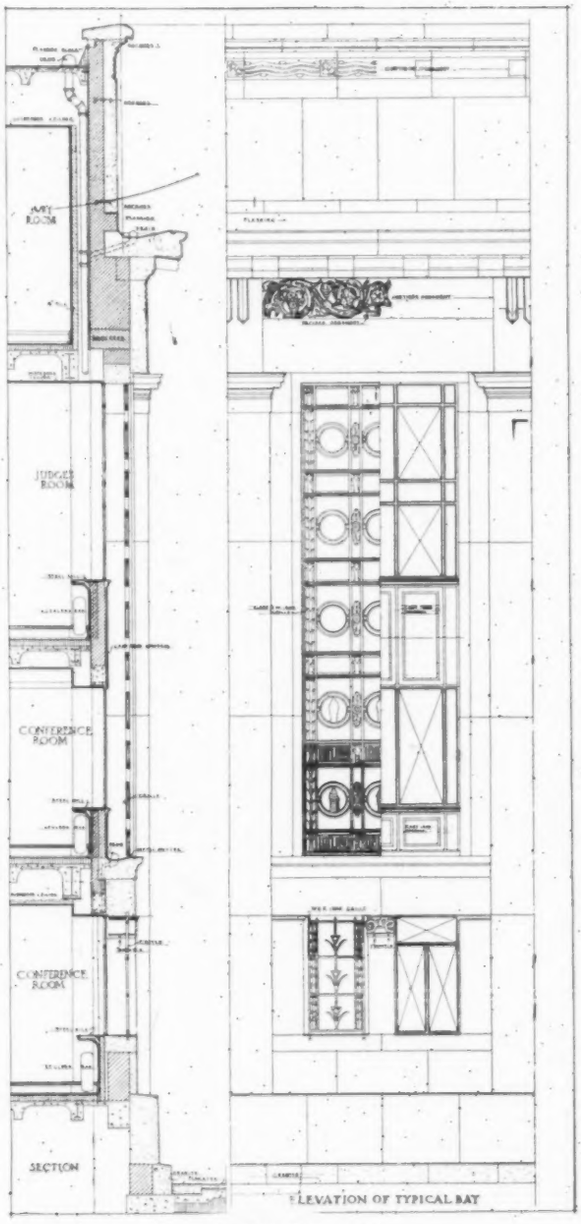


Detail on back

PART OF NORTH ELEVATION

HARTFORD COUNTY BUILDING, HARTFORD

PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS



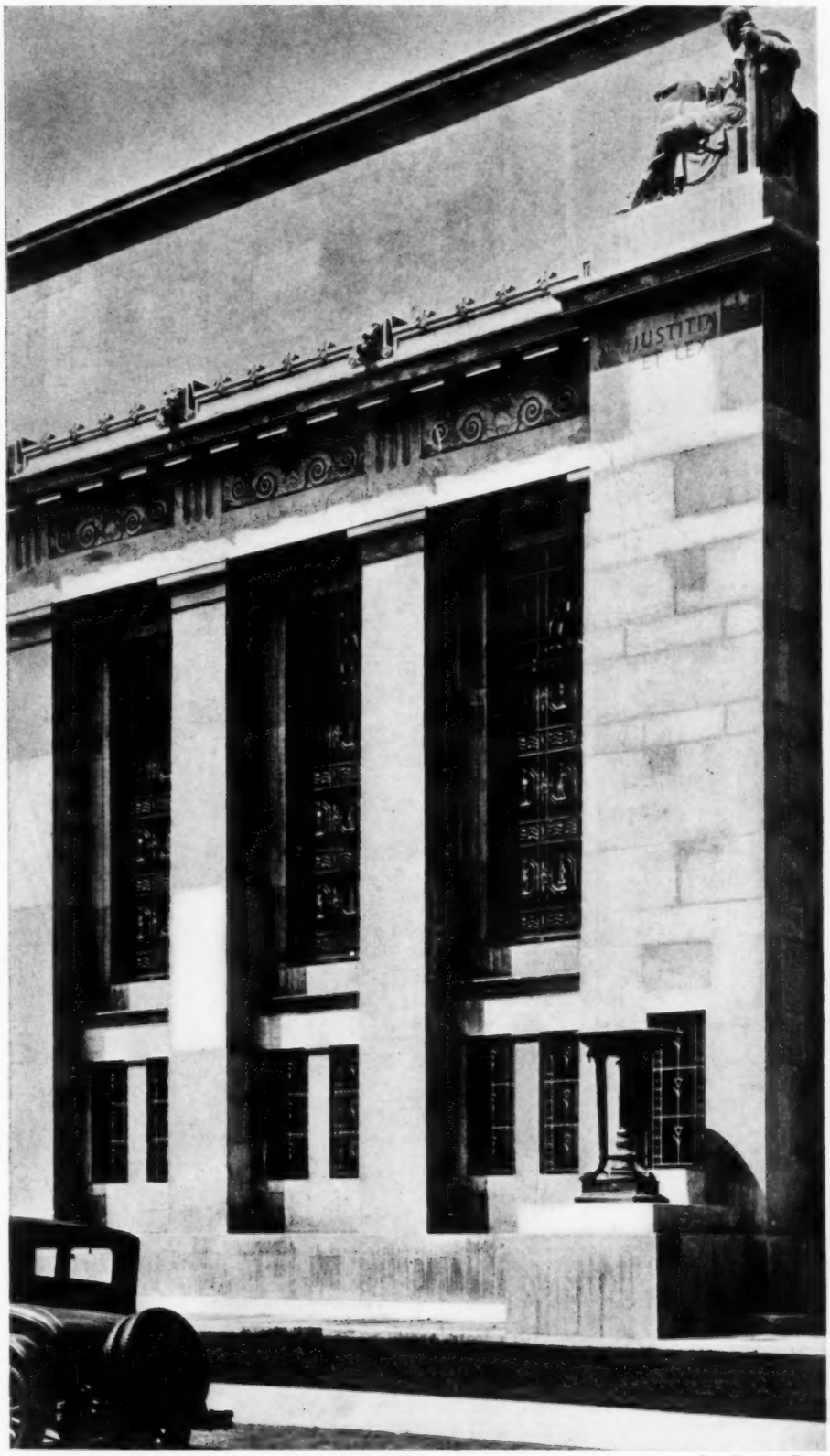
A TYPICAL BAY

NOV. 1929

DETAIL. HARTFORD COUNTY BUILDING, HARTFORD
PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS

No. 7

The Architectural Forum Details



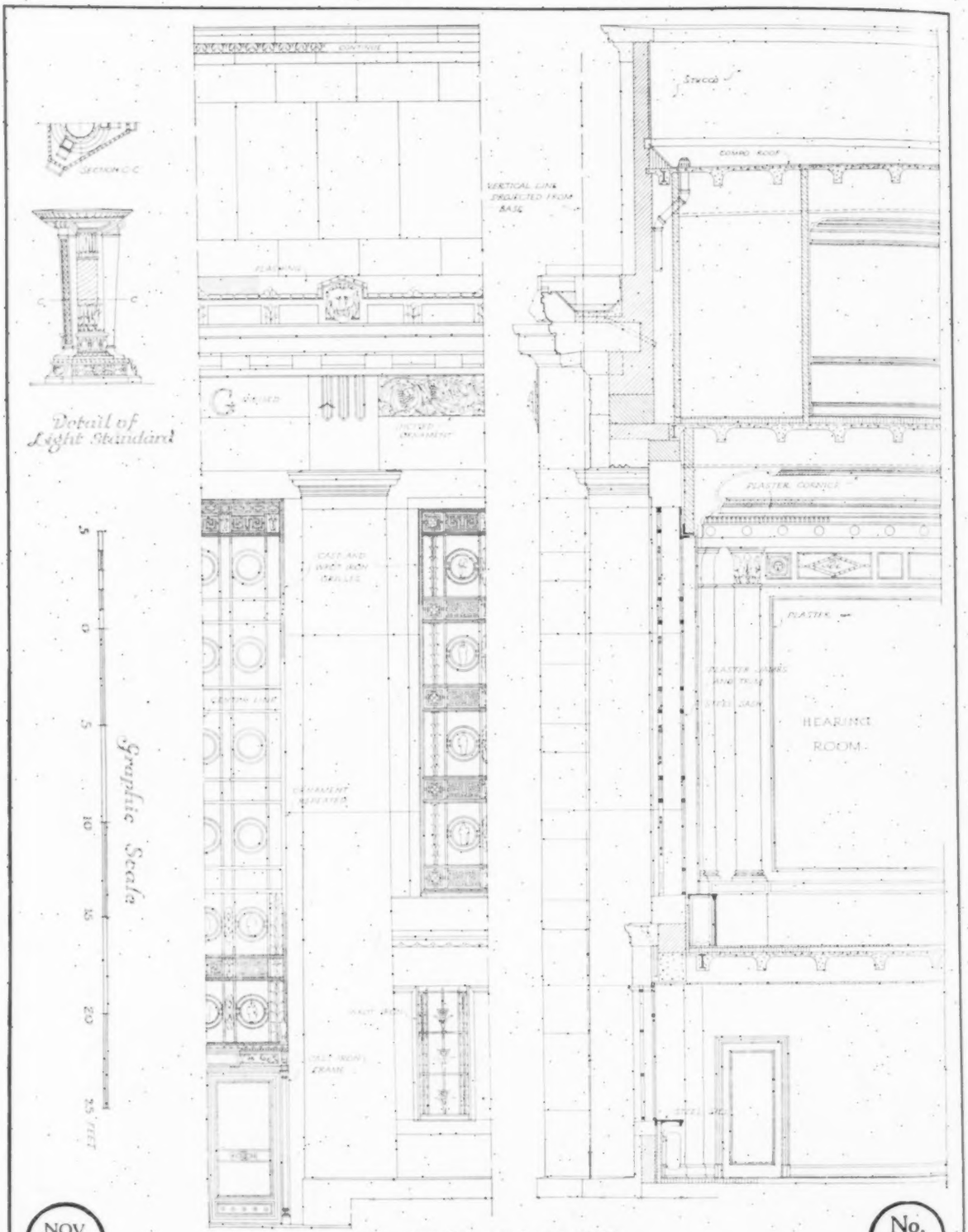
Details on Back

PART OF FRONT ELEVATION

HARTFORD COUNTY BUILDING, HARTFORD

PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS

UNIV OF ILL



NOV 1929

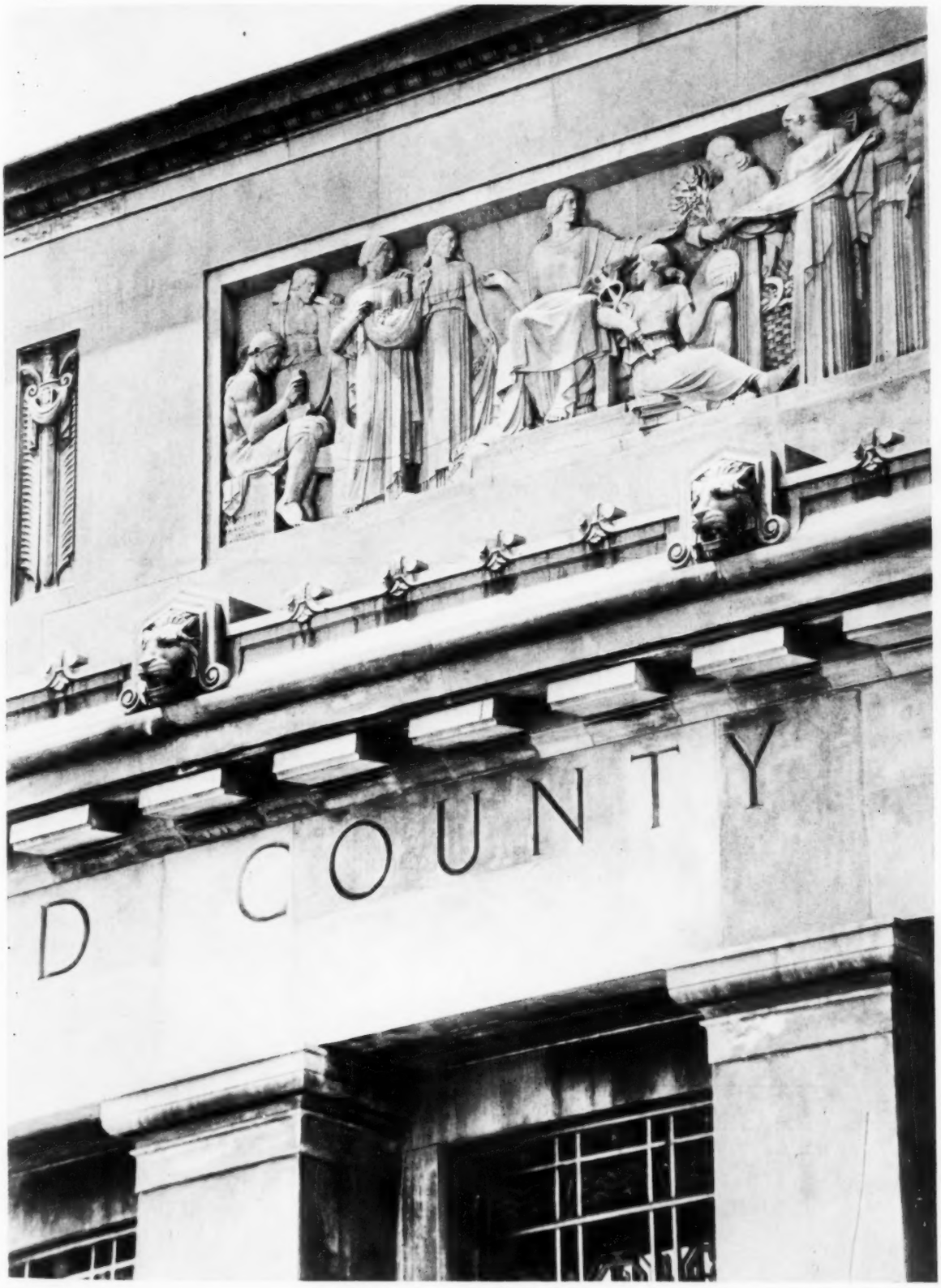
DETAILS OF EAST WALL

DETAILS, HARTFORD COUNTY BUILDING, HARTFORD

PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS

No. 8

The Architectural Forum Details



SCULPTURE, FRONT ELEVATION

HARTFORD COUNTY BUILDING, HARTFORD

PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS

UNIV OF MICH

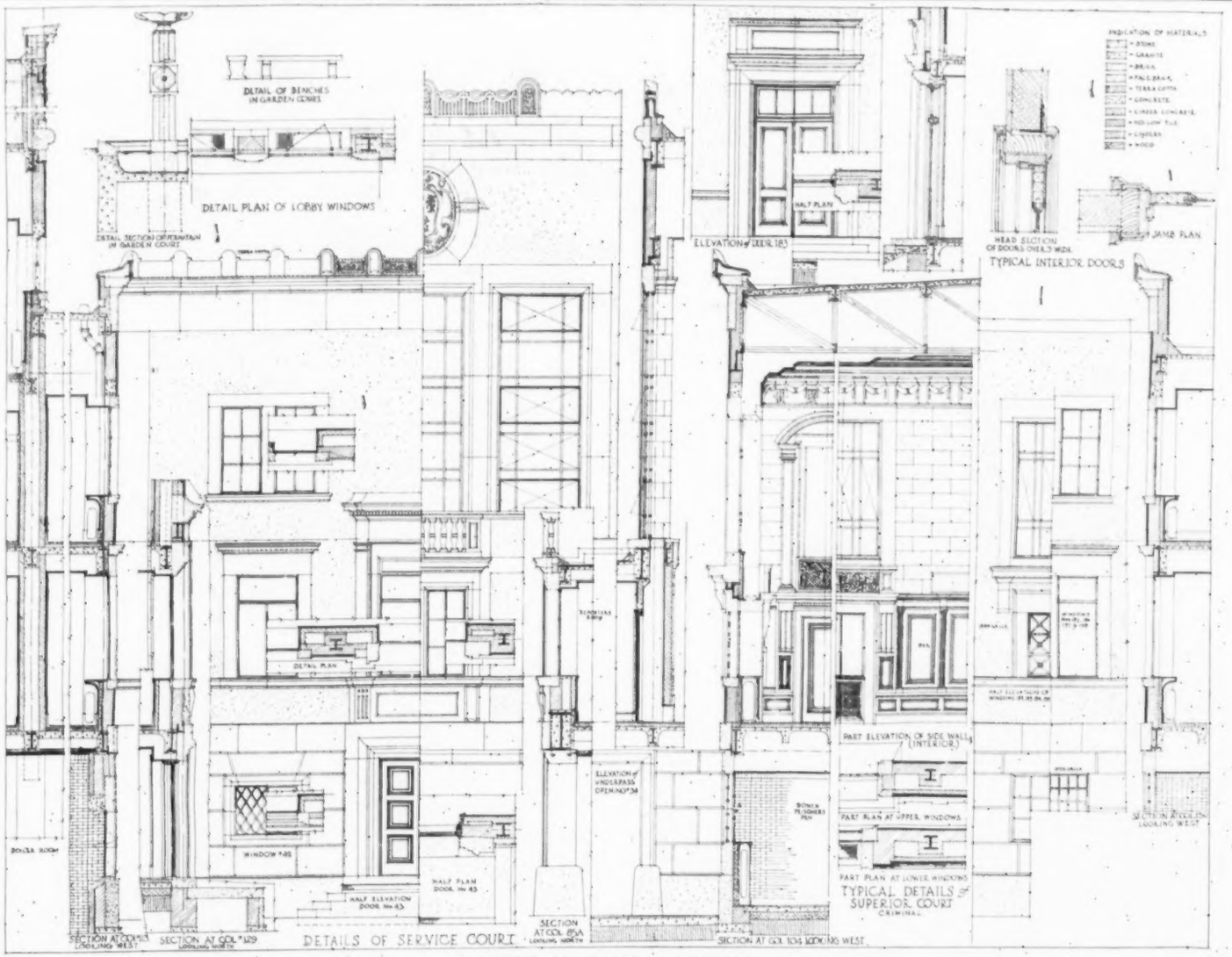
SCULPTURE, FRONT ELEVATION
HARTFORD COUNTY BUILDING, HARTFORD
PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS

Details on Back

COURTYARD

HARTFORD COUNTY BUILDING, HARTFORD

PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS



NOV. 1929

A SHEET OF TYPICAL DETAILS

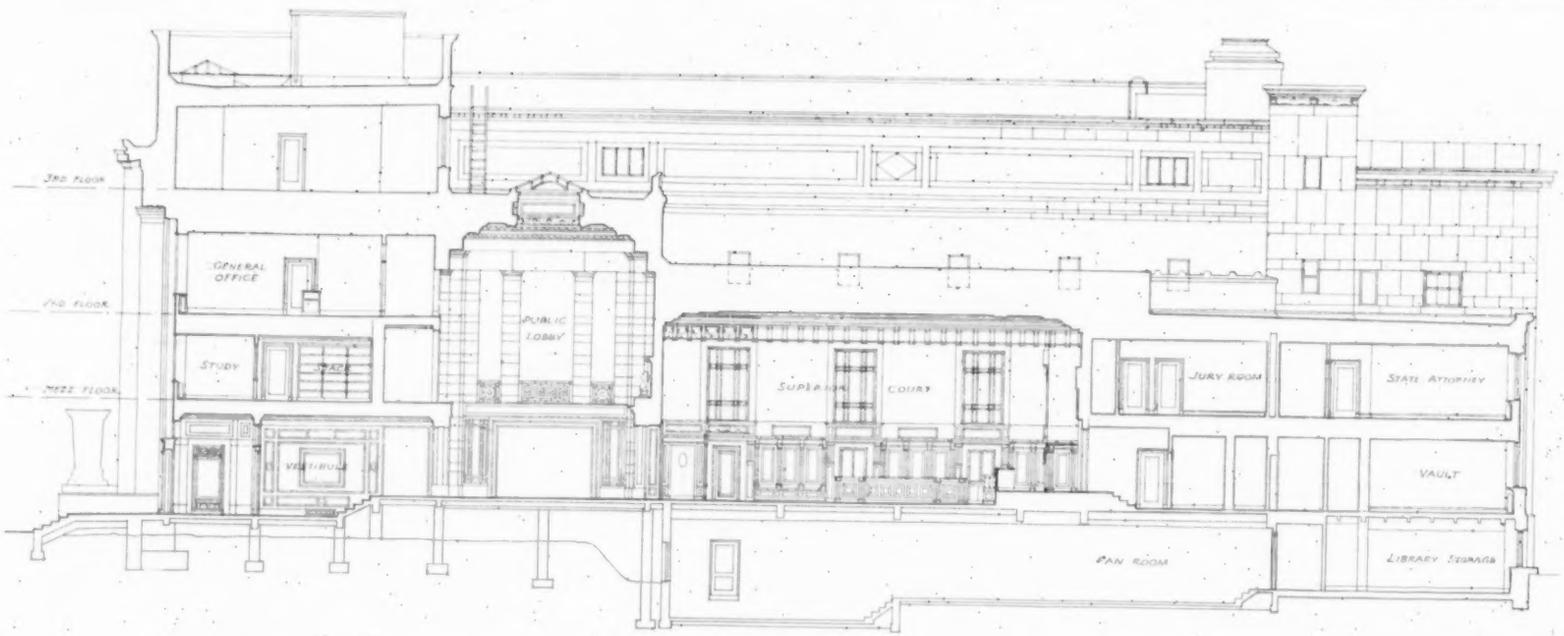
DETAILS. HARTFORD COUNTY BUILDING, HARTFORD

PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS

No. 9

Detail on Back

MAIN LOBBY
HARTFORD COUNTY BUILDING, HARTFORD
PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS



Longitudinal Section looking South

Graphic Scale

10 0 10 20 30 40 50 60 70 80 90 100

NOV. 1929

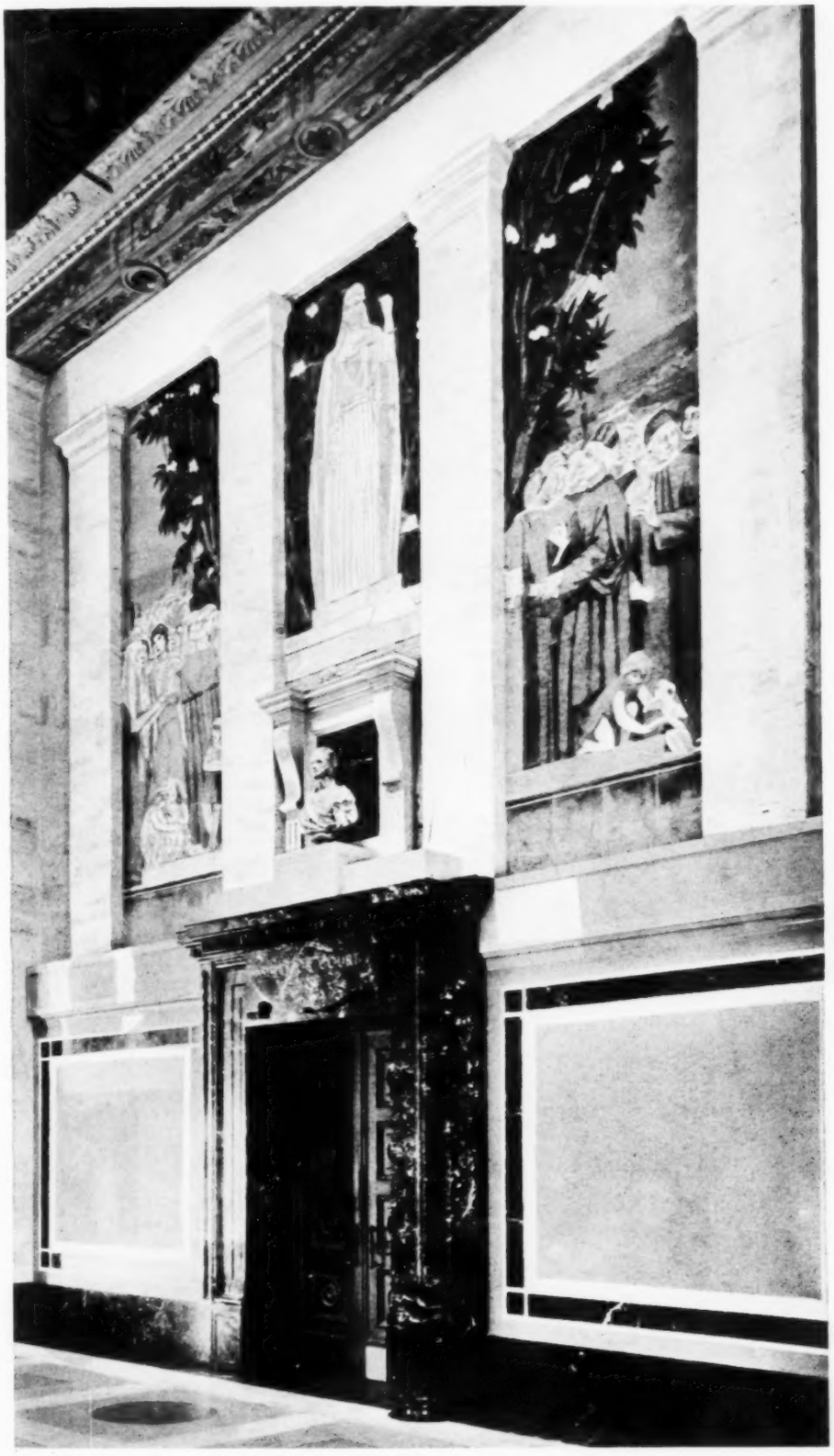
DETAIL. HARTFORD COUNTY BUILDING, HARTFORD

PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS

No. 10

The ARCHITECTURAL FORUM DETAILS

UPPER PART OF MAIN LOBBY
HARTFORD COUNTY BUILDING, HARTFORD
PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS

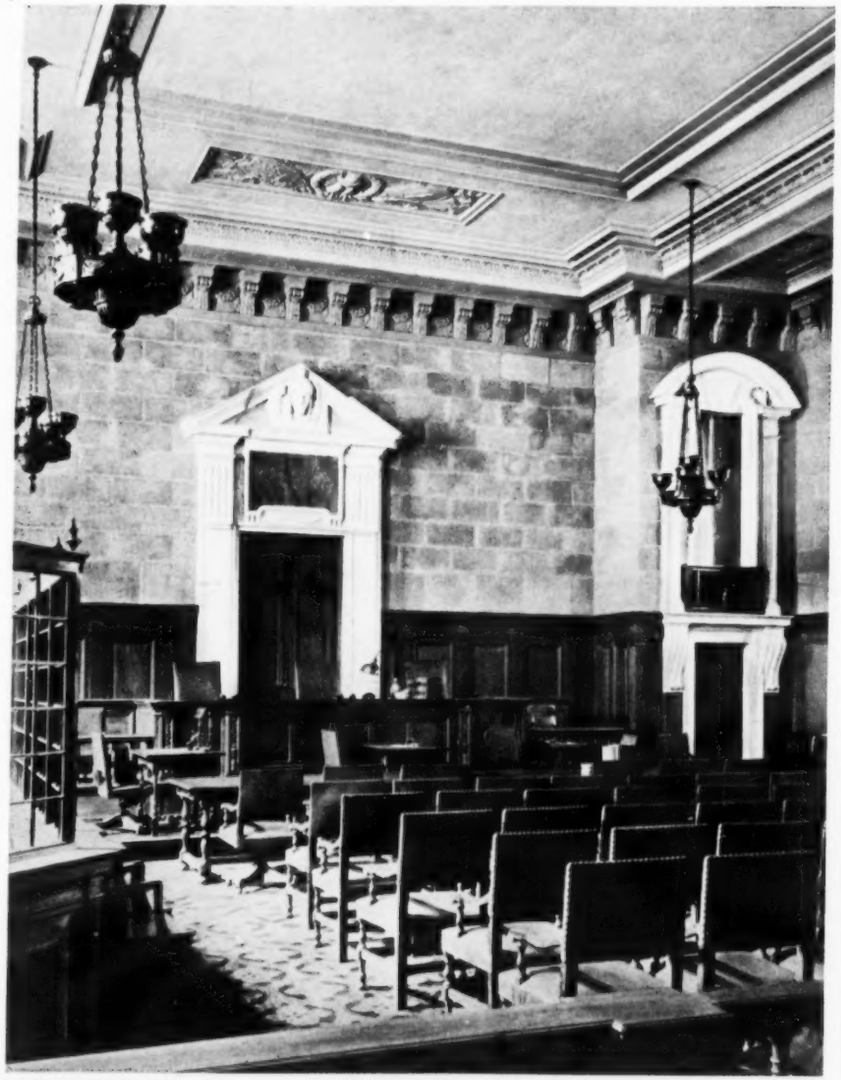


ENTRANCE TO CRIMINAL COURT ROOM
HARTFORD COUNTY BUILDING, HARTFORD
PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS

LIBRARY

HARTFORD COUNTY BUILDING, HARTFORD

PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS

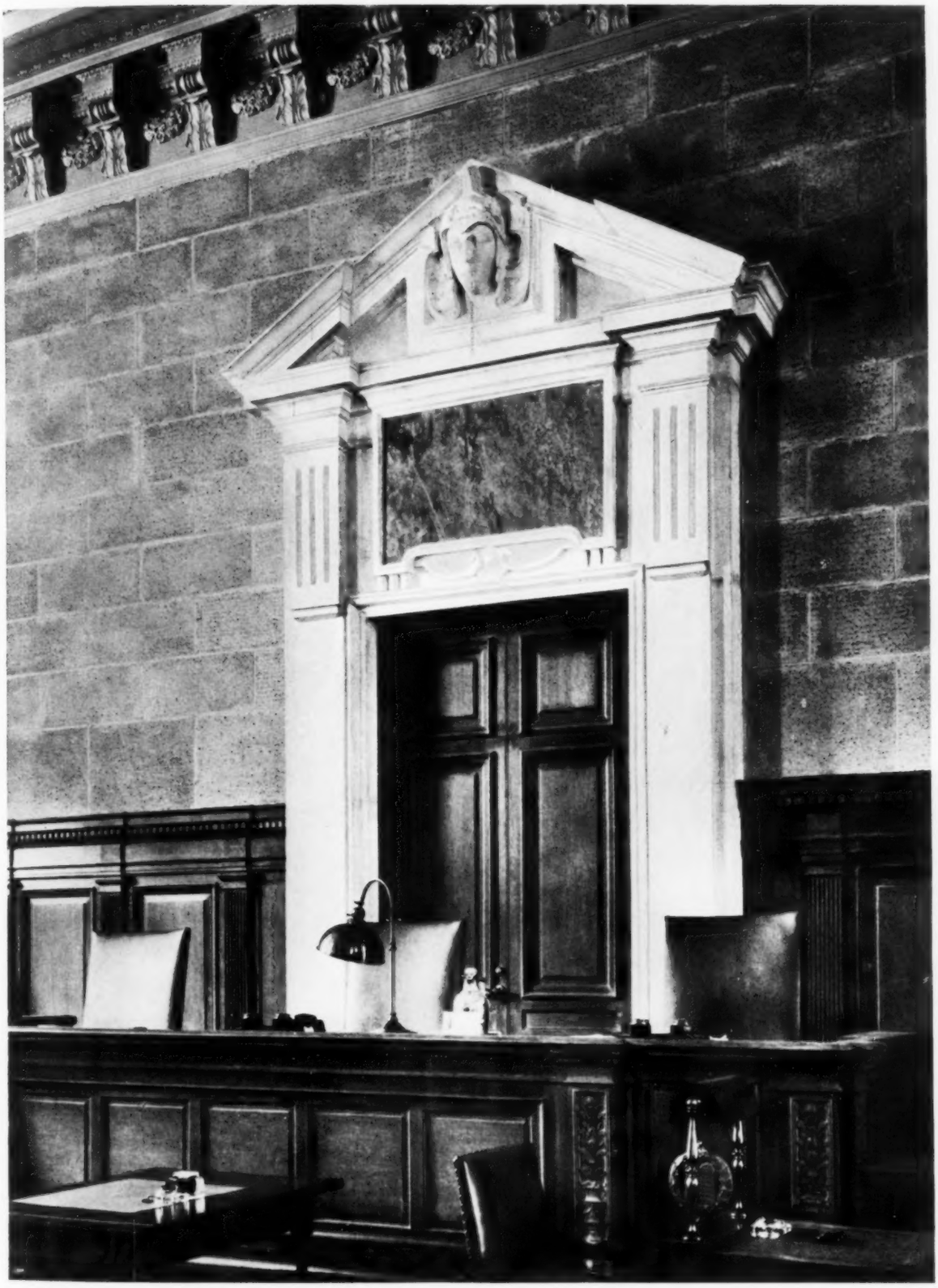


CRIMINAL COURT ROOM

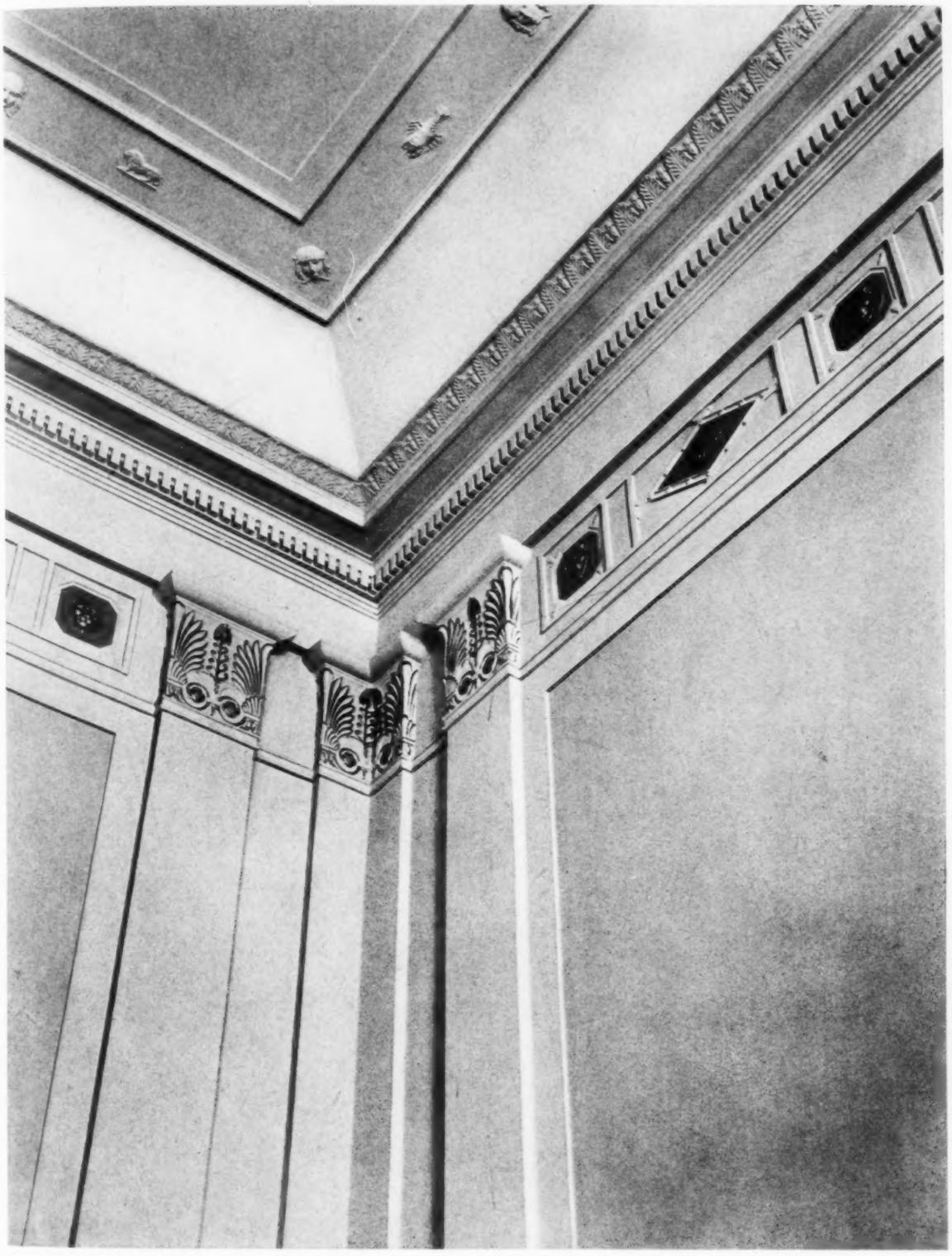
SPECIAL HEARING ROOM

HARTFORD COUNTY BUILDING, HARTFORD

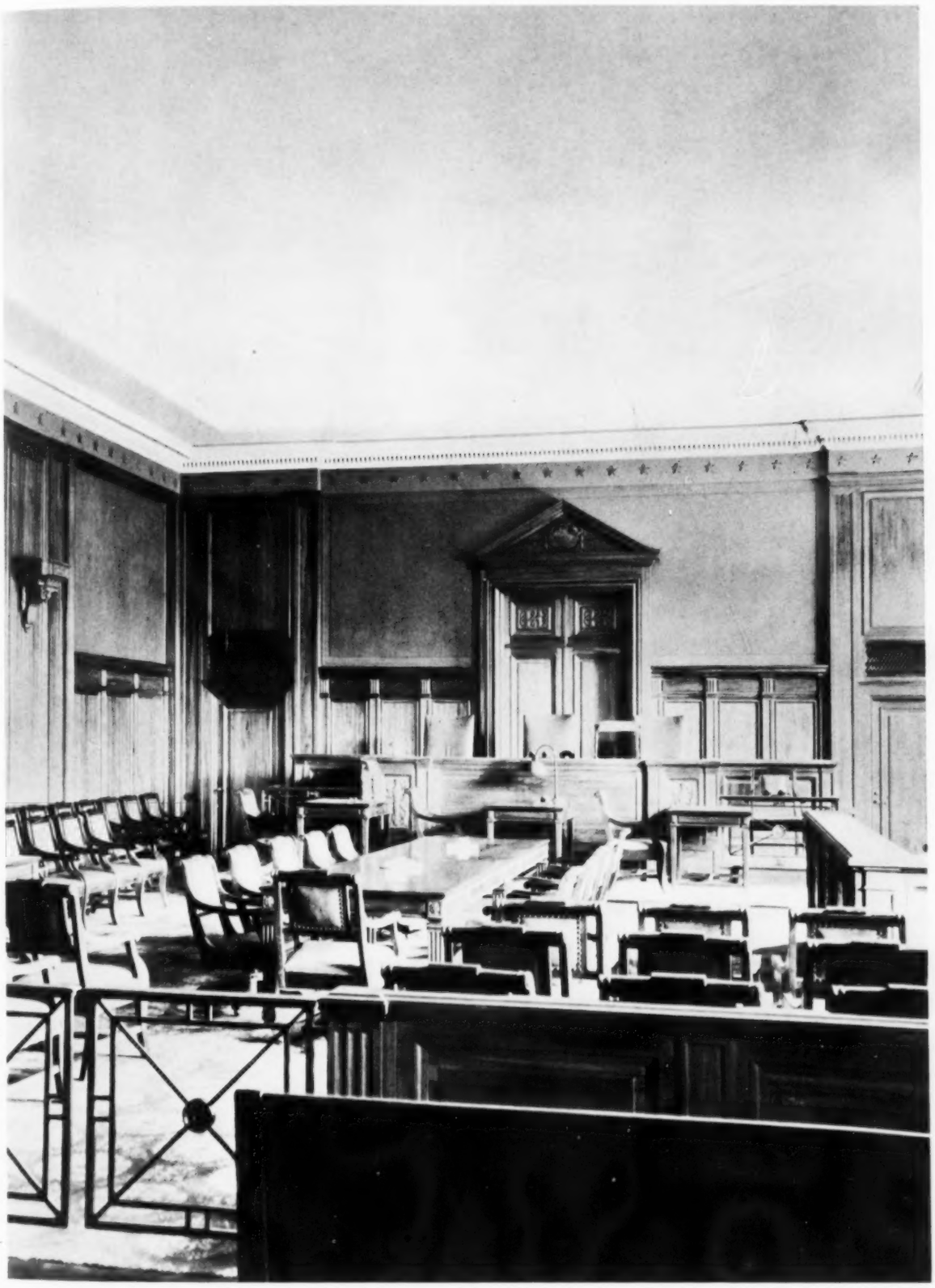
PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS



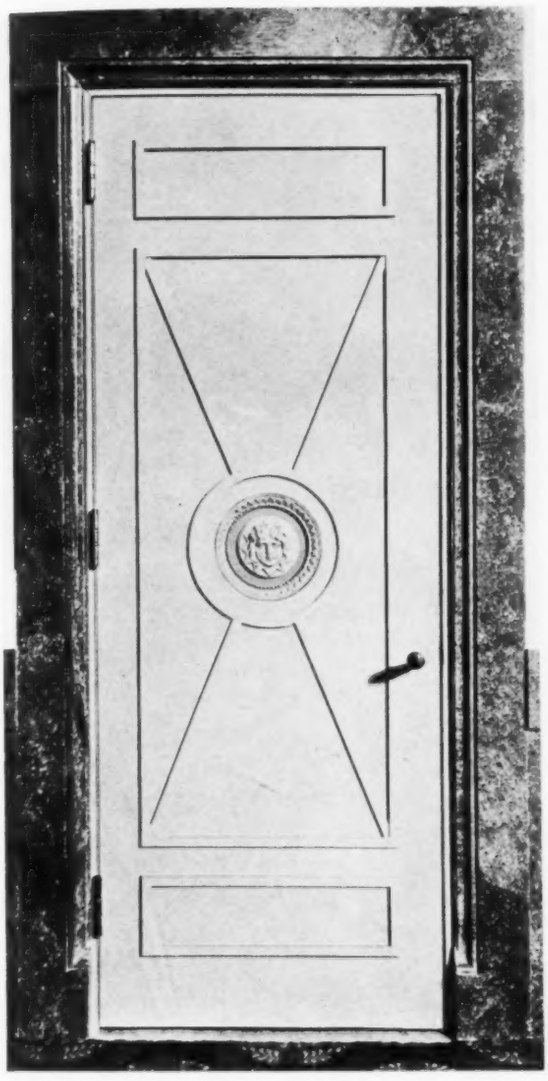
DETAIL, CRIMINAL COURT ROOM
HARTFORD COUNTY BUILDING, HARTFORD
PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS



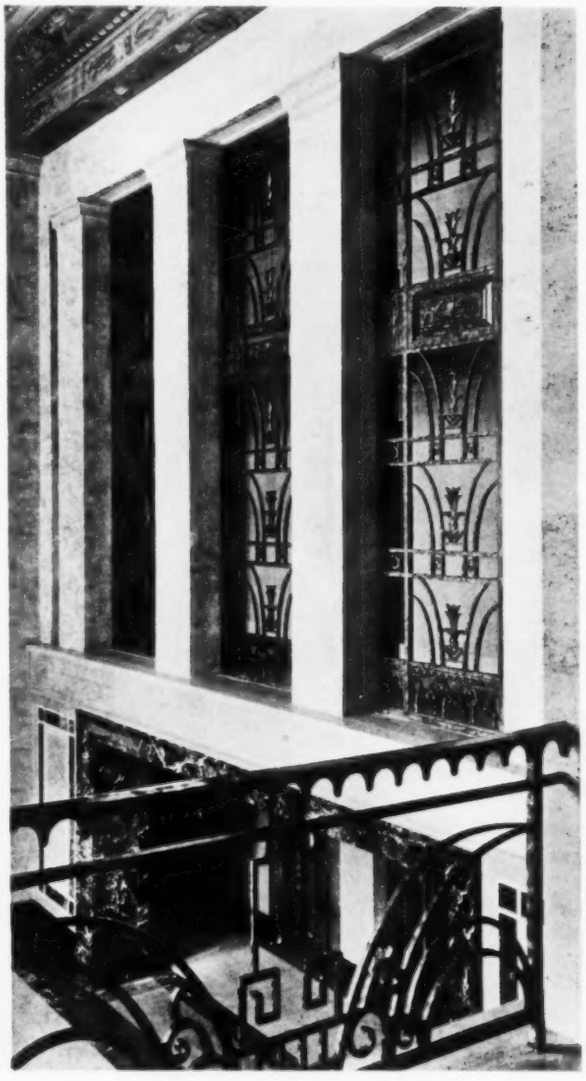
DETAIL, SPECIAL HEARING ROOM
HARTFORD COUNTY BUILDING, HARTFORD
PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS



GENERAL COURT ROOM
HARTFORD COUNTY BUILDING, HARTFORD
PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS



DOOR IN SPECIAL HEARING ROOM



METAL WORK, MAIN LOBBY

HARTFORD COUNTY BUILDING, HARTFORD

PAUL P. CRET AND SMITH & BASSETTE, ASSOCIATED, ARCHITECTS

UNIV OF MICH

THE BARCELONA EXPOSITION
A SPLENDID BUT COSTLY EFFORT OF THE CATALAN PEOPLE

BY

WILLIAM FRANCKLYN PARIS

NOTHING so reflects the character of a nation as its proverbs. The brief, pithy apothegms that fall trippingly from the lips of the man in the street are the distilled essence of centuries of observation and self-analysis; they are the pearls of wisdom handed down from generation to generation; they express the beliefs, the ethics, the morals, the spirit of a people.

To all the world, the word "*Manana,*" which is a condensation of the proverb "Tomorrow will be time enough," has epitomized the indolent character of the Spanish people. The Spanish have always been reactionary. Spanish writers from the eighteenth century down to the day before yesterday wrote of the grandeur that was Spain and concluded with the fatalistic epitaph "*Espana Fuit.*" Industry and trade were matters of contempt. To quote a sententious proverb: "*Iglesia O mar, O casa real quien quiere medrar,*"—"He that would succeed, let him enter the Church, the navy or the king's service."

Hard work is not highly prized among the Spaniards. One of their proverbs has it: "*Mas vale al que Dios ayuda que al que mucho madruga;*" in other words, "He whom God helps need not get up early in the morning." They believe that luck brings greater rewards than honest toil, and many of their proverbs reflect this conviction. "*Contra fortuna,*" they say, "*no vale arte ninguna*": "Against hard luck all art is powerless"; "*All desdichado poco le vale ser esforzado*": "If you are unlucky, there is no use trying"; "*Fortuna te de Dios, hijo, que el saber poco te basta*": "God give you luck, son, for knowledge will serve you but little"; "*Poco te importa el ser sabio si no fueres venturoso*": "Little will it serve you to be wise if you are not lucky as well." As for ambition, its value is appraised in the proverb "What's the use of anything? A man who is born a *cuarto* isn't going to turn out a *peseta.*"

In the face of all this evidence of the procrastinating temperament of the Spaniard, of his satisfaction with things as they are, of his skepticism as to the efficacy of hard work, one is struck with amazement by the splendid demonstration of energy just made in Barcelona where an International Exposition on a scale rivaling that of the expositions of Paris, London or Chicago is being held for the edification of the entire world. When one has been two days in Barcelona, however, one will have had the enigma explained, and when the visitor gets away from the Exposition he will carry with him a special admiration and respect for a particular and distinct type of Spaniard, a Spaniard who believes in hard work and progress,—a Catalan.

Catalonia has its own way of seeing things. As far back as the time of the Spanish-American war it replied to the Castilian cry of "Spain

Maria Christina Avenue, Barcelona Exposition

NIGHT VIEW, BARCELONA EXPOSITION

GENERAL VIEW, BARCELONA EXPOSITION

NIGHT VIEW, NATIONAL PALACE, BARCELONA EXPOSITION

NATIONAL PALACE, BARCELONA EXPOSITION

Maria Christina Avenue, Barcelona Exposition

knows how to die" by the cry of "Catalonia knows how to live." The Catalan point of view has ever been the opposite of the Spanish or Castilian point of view. Madrid governs; the other provinces are passive. Catalonia has an individuality, and it loses no occasion of asserting it. Barcelona pays in taxes to the government one seventh of the national budget and receives practically nothing in return, the cost of the military defences, of the improvement of the port, etc., having been borne entirely by the municipality. The Catalan people occupy the eastern part of the peninsula and the Balearic Islands, and Catalonia extends over 68,000 square kilometers, a territory three times larger than Belgium. Its population exceeds six millions, and as far back as 1885 it sent a petition to the king asking autonomy. This having been denied, a separationist party was formed which is daily growing in numbers. The Catalans are Catalans first, last, and all the time. They have their own dialect, and they print their newspapers and school books in Catalan. They will shoulder the cost of the Exposition,—a ruinous cost,—but they want the credit for doing it. The tax payers of Barcelona have already disbursed 160 million *pesetas* in connection with the construction and maintenance of the Exposition buildings and grounds, and of this amount only 10 million *pesetas* was contributed by the State. The Catalans will even tell you that the Exposition of Seville was deliberately encouraged and its promoters financially assisted by the government to embarrass the promoters of the Barcelona Exposition, to curb Catalonian pride and to nullify its propaganda. The regional spirit is strong in Barcelona, and this is probably an exaggerated view, but it is no secret that Madrid is jealous of Barcelona and envies its prosperity.

What has added to the costliness of the Exposition is the fact that the only available site for it was the side of the mountain of Montjuich, which dominates Barcelona on the south. An area of 400 acres of steep hillside had to be converted into a magnificent park graded into a series of terraces connected by easy slopes. The head landscape architect of Paris, M. Forrestier, was called in, and there is no doubt that he has given Barcelona as noble a series of terrace gardens as are to be found anywhere in Europe. The fact remains, however, that the Park of Montjuich is built on the side of a steep and lofty mountain, and that its ascent involves some puffing. Visitors to the Exposition who view it in the orthodox

Magic Fountain Square, Barcelona Exposition

way, from the base to the summit, have a laborious time of it, and one viewing it from the top down has the inconvenience of viewing the buildings from the rear or from some angle not contemplated by the architects.

The monumental gate to the Exposition is at the base of Montjuich Hill. It opens off an oval plaza, designated as the Plaza de Espana, at the center of which is a monumental fountain designed by the architect, Jose Maria Jujol, with sculpture symbolizing the Tagus, the Guadalquivir and the Ebro, by Miguel Blay. On the side of the plaza upon which the entrance is located, two colonnaded buildings serve as wings to two rectangular towers rising to the height of 47 meters and obviously inspired by the campanile in Venice. The structures that flank these two towers are built on a concave curve, with a Renaissance peristyle for the Transportation Building and a Grecian peristyle for the Palace of Dress. The first is by the architects A. Florensa and F. de Azua, and the second by J. M. Jujol and A. Calzada. There is nothing particularly original about either, and they reflect, as do most of the Exposition's buildings, a respect for tradition and a close following of the models of the past. The influence of the Paris Exposition of Art Moderne of 1925 has not been felt by the architects of the Barcelona Exposition.

On the main axis with the monumental entrance runs a broad avenue, at the head of which, on an elevation of several hundred feet, reached by the pedestrian by ascending a million steps disposed on either side of a wide cascade, is the *clou* of the Exposition, the National Palace, a huge edifice covering 32,000 square meters and containing an auditorium seating 20,000. This is a well balanced structure, designed by the architects D. Enrique Cata and Pedro Cendoya from two perfectly good models,—the Escorial and St. Peter's in Rome. It has side towers rising to a height of 60 meters, a little ornate in design, but the ensemble strikes the eye with perfect expectedness and does not offend, unless lack of inventiveness and originality constitutes offence.

If so, the Moderns will criticize the State Building, by the architect Antonio Darder, which is almost a reproduction of the Monterey Palace at Salamanca, and the Palace of Deputations by Enrique Sagnier, a pleasing symmetrical structure of Gothic Plateresque architecture, the prototype of which may be found in many Spanish municipalities. This thraldom to old formulæ is less apparent in the Textile Building by Juan Roig

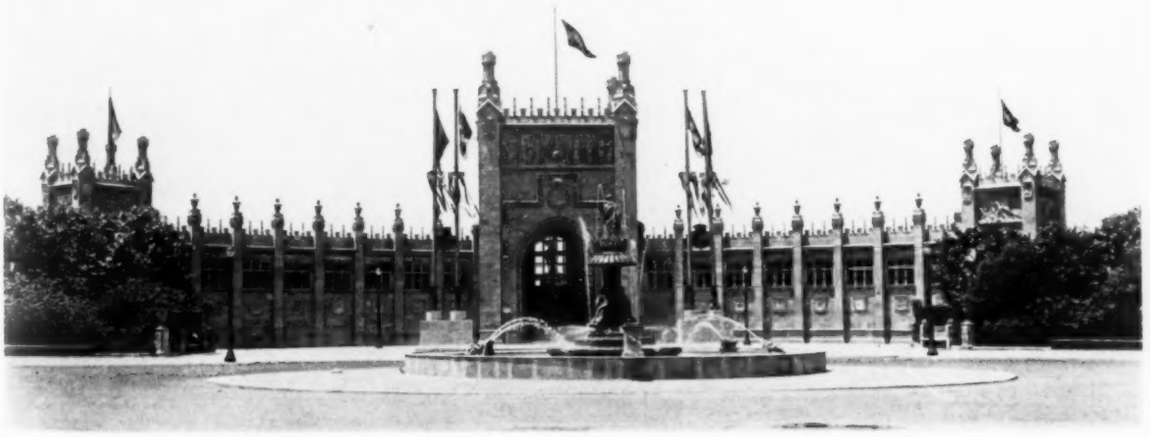
NATIONAL PALACE

COMMUNICATIONS AND TRANSPORTS PALACE
A. FLORENSA AND F. DE AZUA, ARCHITECTS

PAVILION OF THE CITY OF BARCELONA, BARCELONA EXPOSITION
JOSE GODAY, ARCHITECT

MODERN ART PALACE
ANTONIO DARDER, ARCHITECT

PALACE OF DRESS
J. M. JUJOL AND A. CALZADA, ARCHITECTS

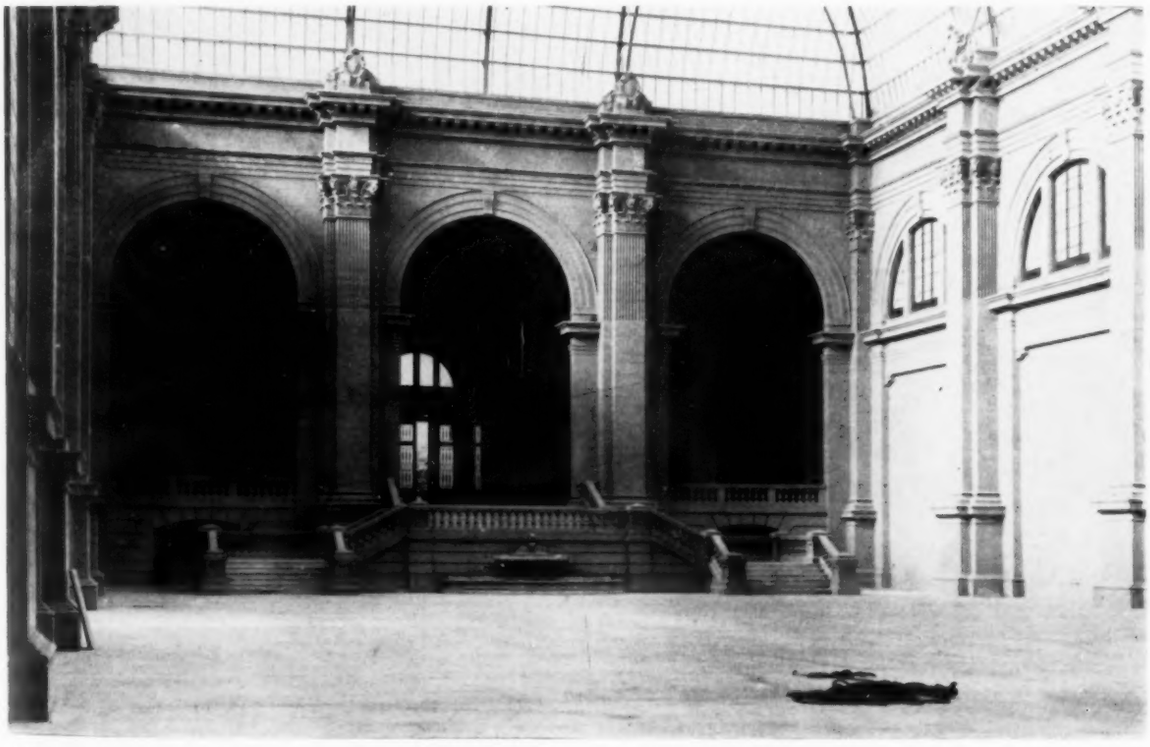


PALACE OF DEPUTATIONS, BARCELONA EXPOSITION
ENRIQUE SAGNIER, ARCHITECT

PALACE OF TEXTILE ARTS
D. E. CANOSA AND JUAN ROIG, ARCHITECTS

PALACE OF GRAPHIC ARTS, BARCELONA EXPOSITION

EXTERIOR VIEW, PALACE OF DECORATIVE AND APPLIED ARTS



INTERIOR VIEW, PALACE OF DECORATIVE AND APPLIED ARTS, BARCELONA EXPOSITION
MANUEL PUIG AND D. M. CADES, ARCHITECTS

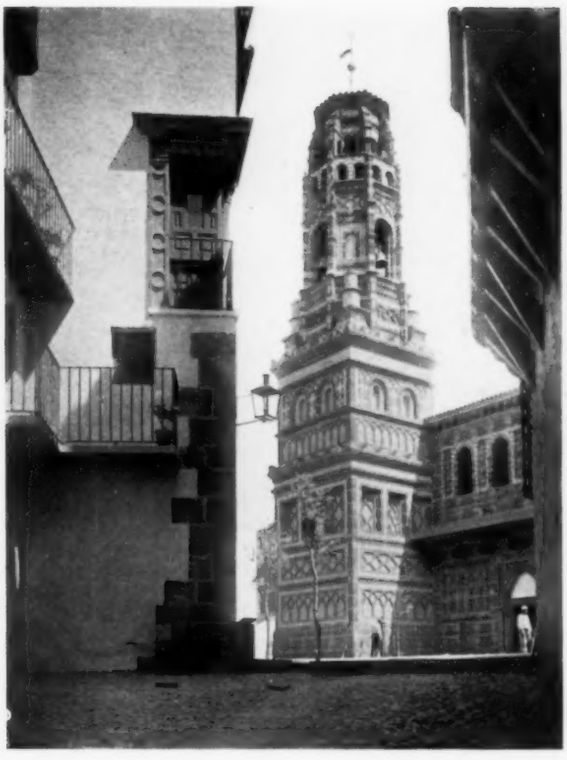
STREET SCENE IN SPANISH VILLAGE

IN THE SPANISH VILLAGE, BARCELONA EXPOSITION

MONASTERY IN SPANISH VILLAGE

WALL FOUNTAIN, SPANISH VILLAGE, BARCELONA EXPOSITION

STREETS IN THE SPANISH VILLAGE, BARCELONA EXPOSITION



DETAILS FROM THE SPANISH VILLAGE, BARCELONA EXPOSITION

THE PLAZA AND SIDE STREETS, SPANISH VILLAGE, BARCELONA EXPOSITION

THE PLAZA AND ROMANESQUE MONASTERY, SPANISH VILLAGE, BARCELONA EXPOSITION

The Plaza of Fountains at Night, Barcelona Exposition

and D. E. Canosa, although here also a ready-made Spanish Renaissance cornice marks the roof line. Neither the Palace of Graphic Arts, nor the Palace of Industrial and Applied Arts by Manuel Puig and D. M. Cades, which blend the Renaissance and the Baroque, have anything to recommend them. The Pavilion of the City of Barcelona, by Jose Goday, on the other hand, has distinct personality, and its brick facade, ornamented with gilt bronze sculpture and with an upper loggia in perfect proportion with the symmetrical two-story division of the building, is pleasing.

Perfectly proper and decorously orthodox are the other minor buildings, all designed in obedience to tradition. Mention might be made of the Modern Art Building, which is anything but modern, and the Royal Pavilion, which is a greater success chromatically than architecturally.

The coöperation of foreign nations has not been in keeping with the effort of Barcelona. Italy, Belgium, France, Germany, Denmark, Hungary, Norway, Rumania, Sweden, and Yugoslavia have buildings of sorts, but only Italy, Belgium and France have erected distinctive and consequential pavilions. France's pavilion is by Georges Wybo and is of "tempered modern" architecture. Italy's is more pretentious. It covers 4,500 square meters and is rich in marble and mosaic, while Belgium's, by the architect Verhelle, is pure Flemish of the time of the Spanish domination over Flanders. As for the United States, it is conspicuous by its absence. It seems that, being represented at Seville, it could not afford to be represented at Barcelona also. In consequence, the American firms who exhibit have their manufactures displayed in various and sundry buildings,—Agriculture, Machinery, Decorative Arts, etc.

No article on the Exposition would be complete that did not take into consideration one of the Exposition's "concessions," a private undertaking exacting an added admission tax, but embodying in a series of faithful reproductions, examples of Spain's most picturesque and most characteristic architecture. The visitor finds himself suddenly transported into some old quarter of Castile or Aragon, or else he walks up the tortuous steps of an Andalusian street to come upon a church tower of the purest Aragonese-Mudejar style, a copy of the campanile of Utebo, in the Province of Saragossa. Or else he will watch native dances in native costumes performed in a *plaza mayor*, typical of a thousand such to be found in every province of Spain, with its *Ayuntamiento* building, in this case a reproduction of the City Hall of Valleder obles in the Province of Teruel. There is a city gate, a copy on a smaller scale of the famous Puerta de San Vincente of Avila, and the entire 20,000 square meters area of the "village" is enclosed by an ancient city wall. Along the streets, facing the square are typical shops, inns and dwellings, inhabited by supposedly authentic citizens of the particular provinces pictorialized, who are serving native dishes in native costumes and singing local and regional songs and selling local and regional products.

The directing hand and eye which selected the various architectural units to be reproduced are to be congratulated not only on the choice made, but in the skill shown in assembling them with never any apparent anachronism. When one is within the walls of the Spanish *pueblo*, one is in old Spain, completely untouched by progress.

GENERAL VIEW

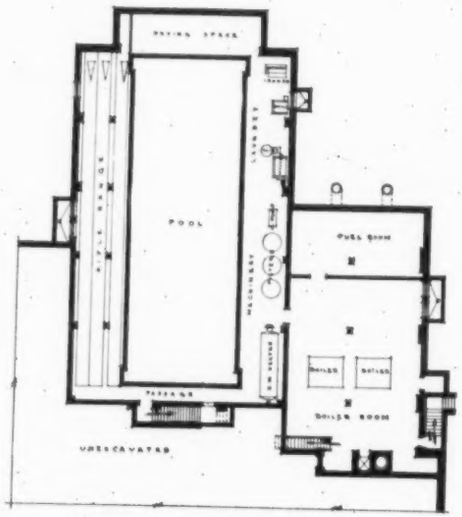
Photos. Barlow *Plans on Back*

SWIMMING POOL

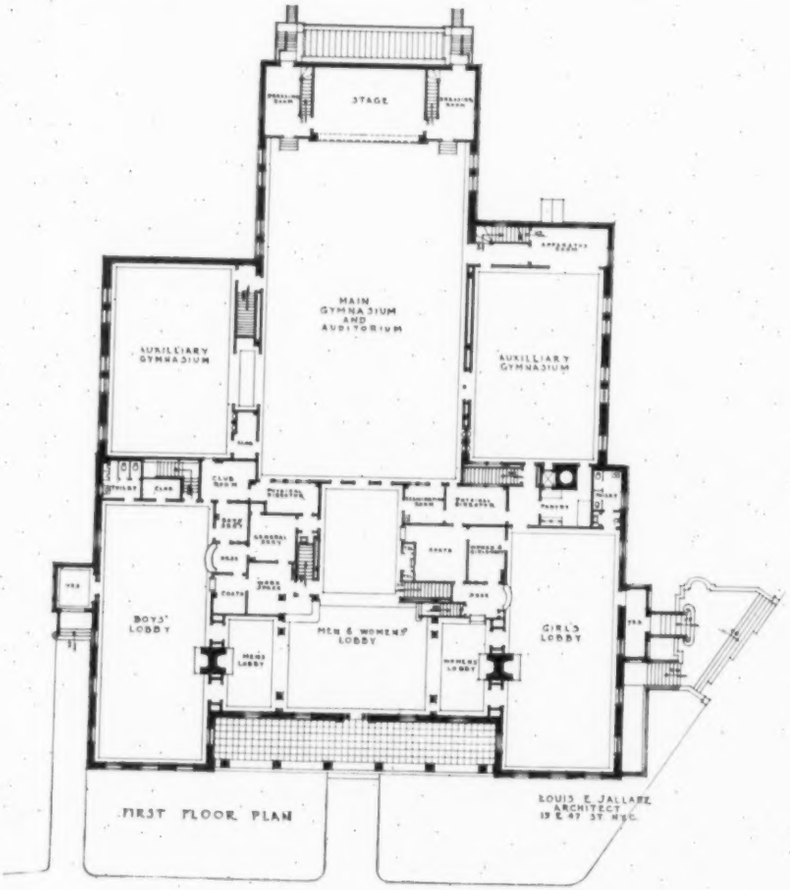
YOUNG MEN'S CHRISTIAN ASSOCIATION BUILDING, HACKENSACK, N. J.

LOUIS E. JALLADE, ARCHITECT

UNIV. OF MICH.



SUB-BASEMENT



BASEMENT

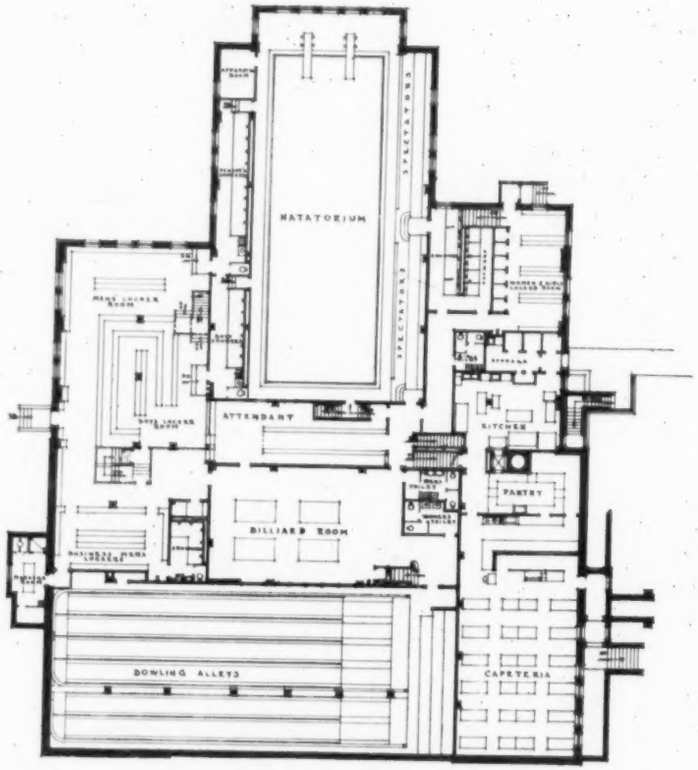
PLANS, YOUNG MEN'S CHRISTIAN ASSOCIATION BUILDING, HACKENSACK, N. J.
LOUIS E. JALLADE, ARCHITECT

Plans on Back

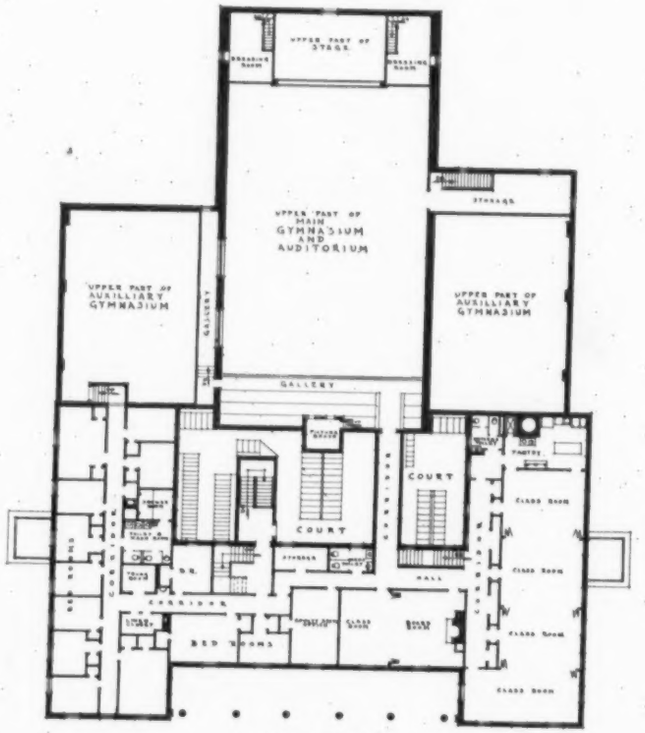
MAIN ENTRANCE

YOUNG MEN'S CHRISTIAN ASSOCIATION BUILDING, HACKENSACK, N. J.

LOUIS E. JALLADE, ARCHITECT

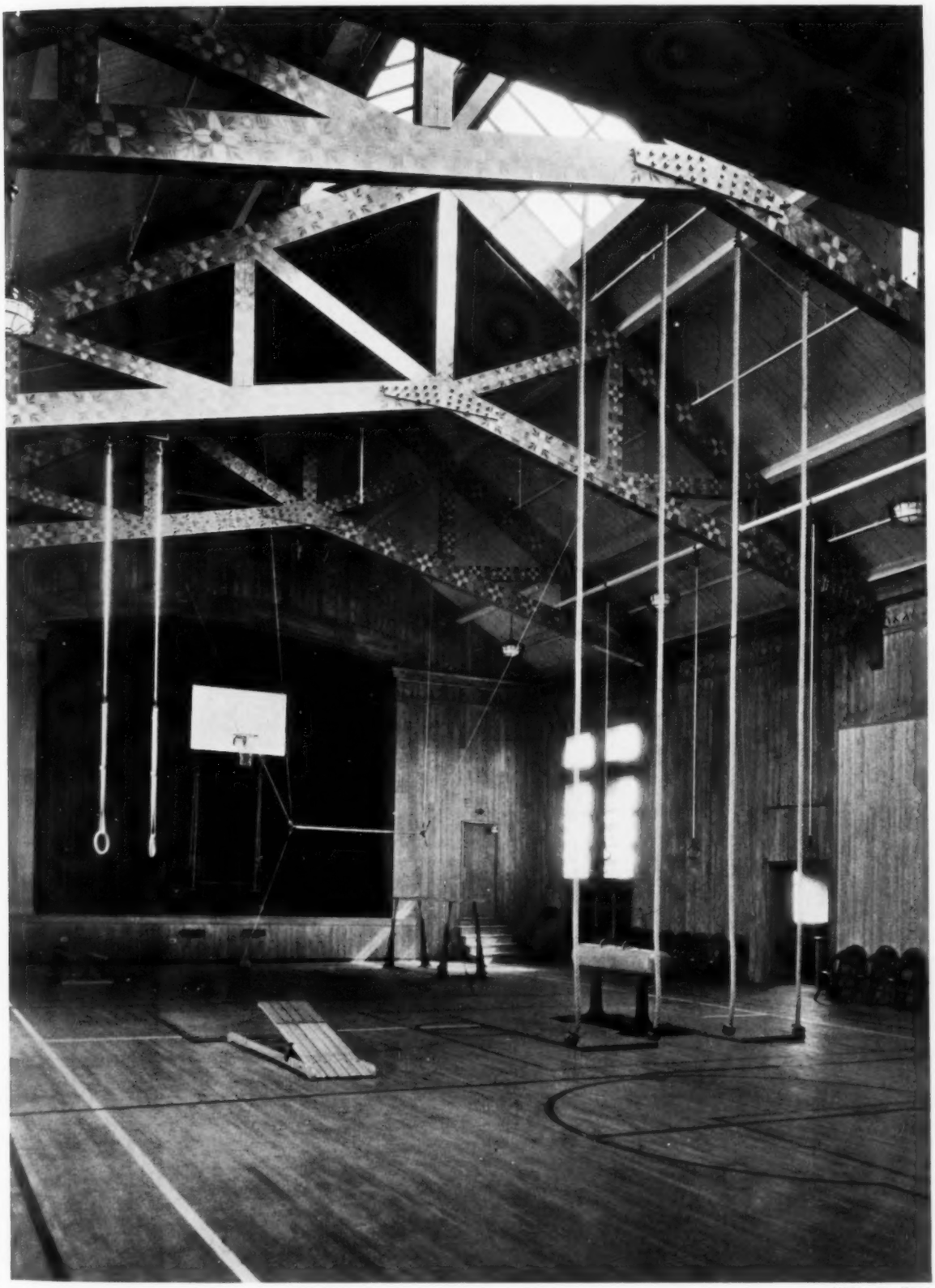


FIRST FLOOR



SECOND FLOOR

PLANS, YOUNG MEN'S CHRISTIAN ASSOCIATION BUILDING, HACKENSACK, N. J.
LOUIS E. JALLADE, ARCHITECT

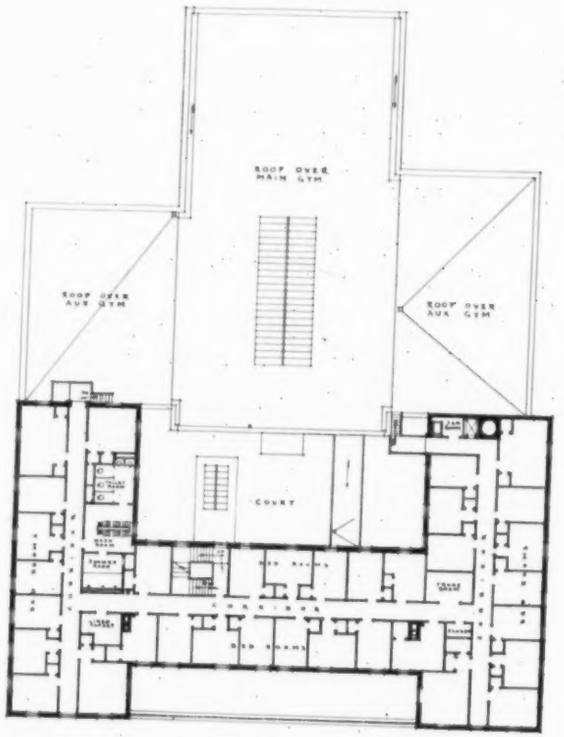


Plans on Back

GYMNASIUM

YOUNG MEN'S CHRISTIAN ASSOCIATION BUILDING, HACKENSACK, N. J.

LOUIS E. JALLADE, ARCHITECT



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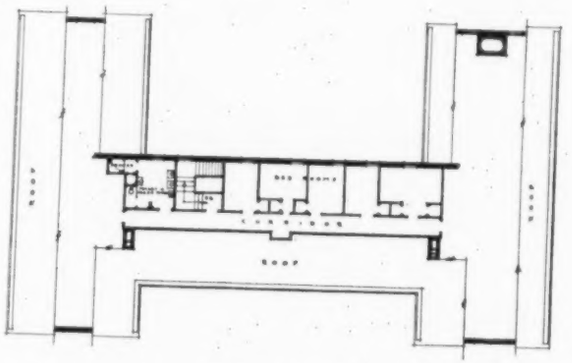
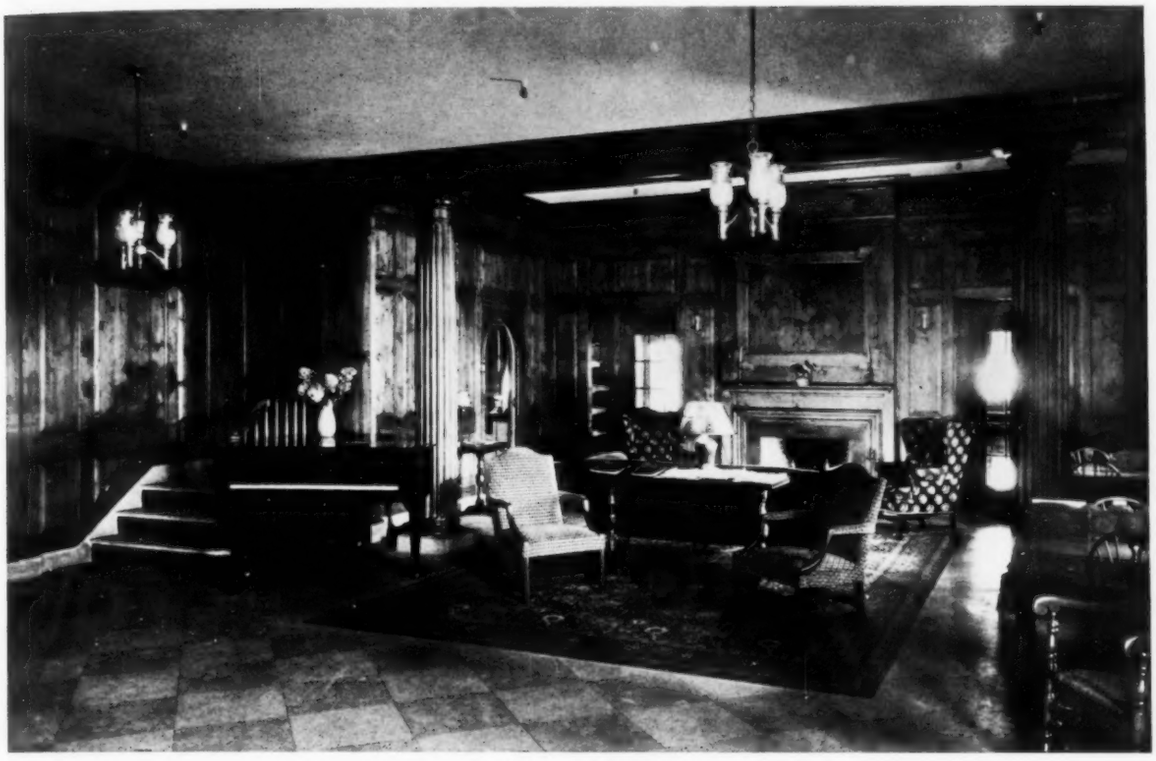


FOURTH FLOOR

PLANS. YOUNG MEN'S CHRISTIAN ASSOCIATION BUILDING, HACKENSACK, N. J.
LOUIS E. JALLADE, ARCHITECT

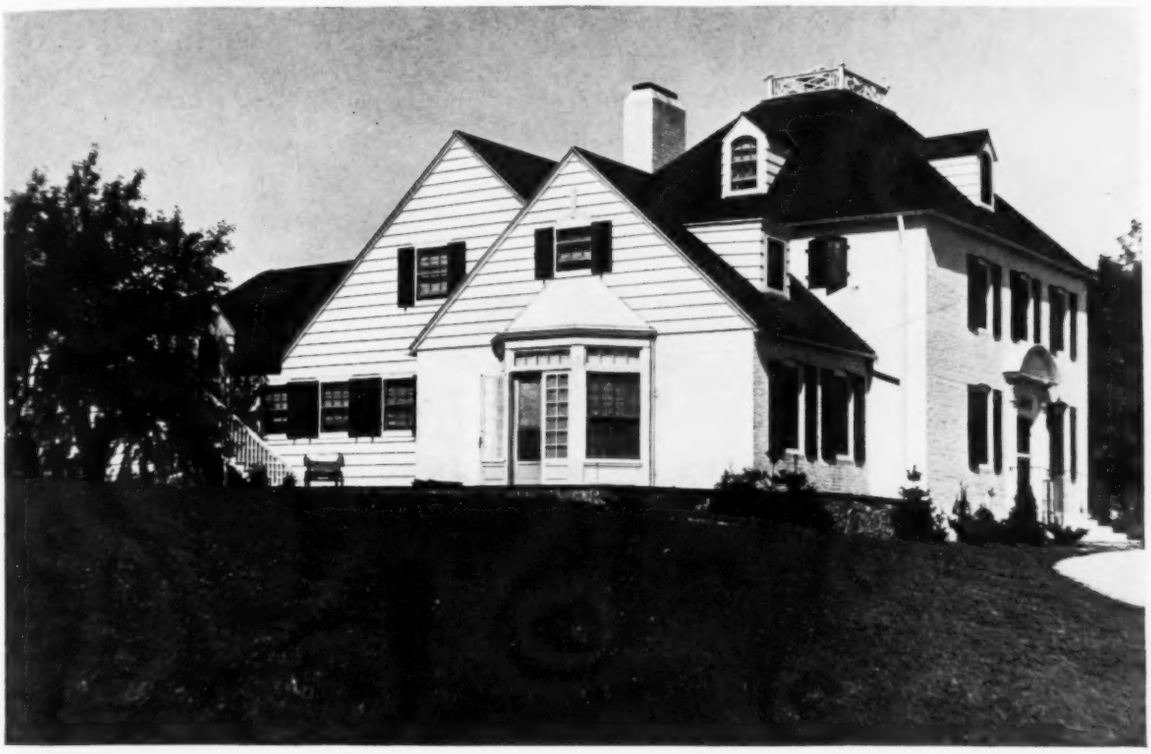


WOMEN'S LOBBY

MAIN LOBBY

YOUNG MEN'S CHRISTIAN ASSOCIATION BUILDING, HACKENSACK, N. J.

LOUIS E. JALLADE, ARCHITECT



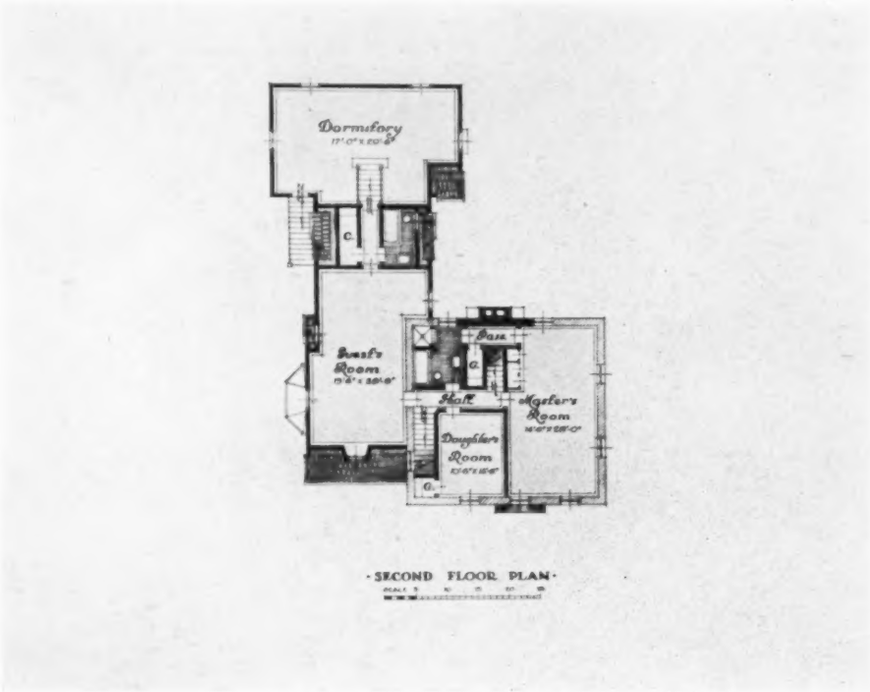
VIEW FROM THE SOUTHWEST

Photos. Trowbridge *Plans on Back*

SERVICE WING

ALTERATIONS TO THE HOUSE OF FRANK L. BATEMAN, ESQ., BARRINGTON, ILL.

HUSZAGH & HILL, ARCHITECTS



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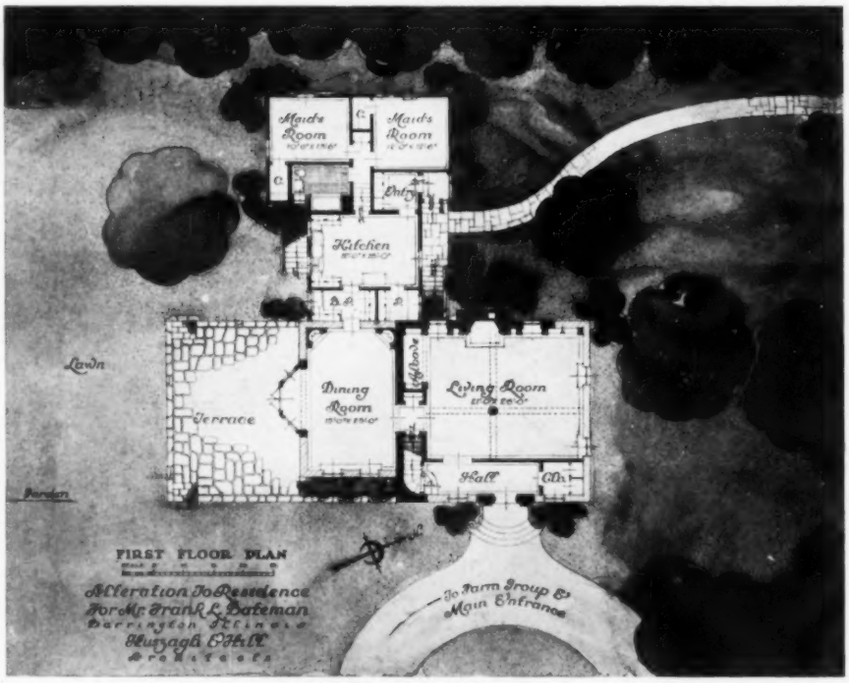


FIRST FLOOR

PLANS. ALTERATIONS TO HOUSE OF FRANK L. BATEMAN, ESQ., BARRINGTON, ILL.
HUSZAGH & HILL, ARCHITECTS

MAIN ENTRANCE DOOR

STAIR TO SERVANTS' DORMITORY

ALTERATIONS TO THE HOUSE OF FRANK L. BATEMAN, ESQ., BARRINGTON, ILL.

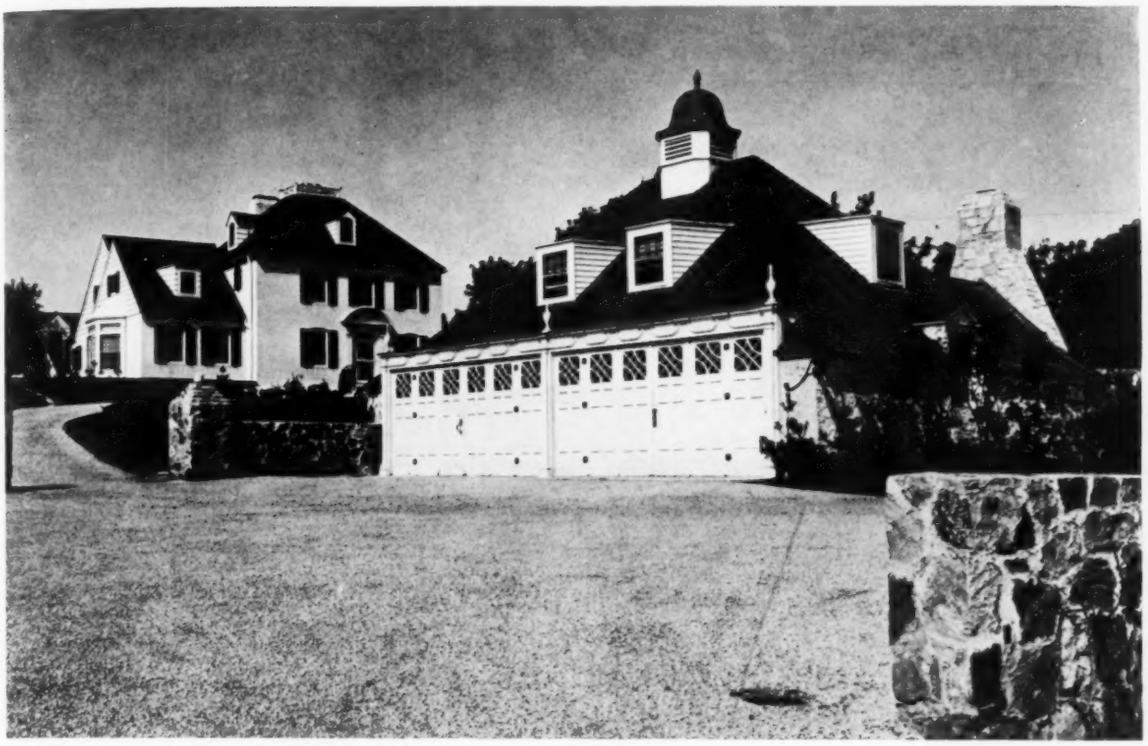
HUSZAGH & HILL, ARCHITECTS

CORNER OF DINING ROOM

GUEST ROOM

ALTERATIONS TO THE HOUSE OF FRANK L. BATEMAN, ESQ., BARRINGTON, ILL.

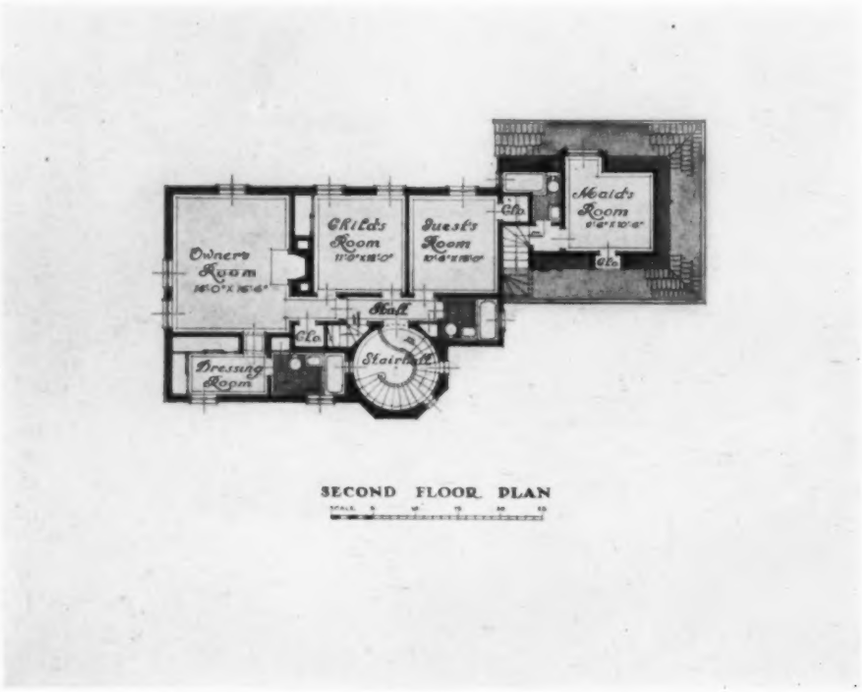
HUSZAGH & HILL, ARCHITECTS



GARAGE AND OFFICE
ESTATE OF FRANK L. BATEMAN, ESQ., BARRINGTON, ILL.
HUSZAGH & HILL, ARCHITECTS

Photos. Trowbridge *Plans on Back*

HOUSE OF RALPH D. HUSZAGH, ESQ., WINNETKA, ILL.
HUSZAGH & HILL, ARCHITECTS



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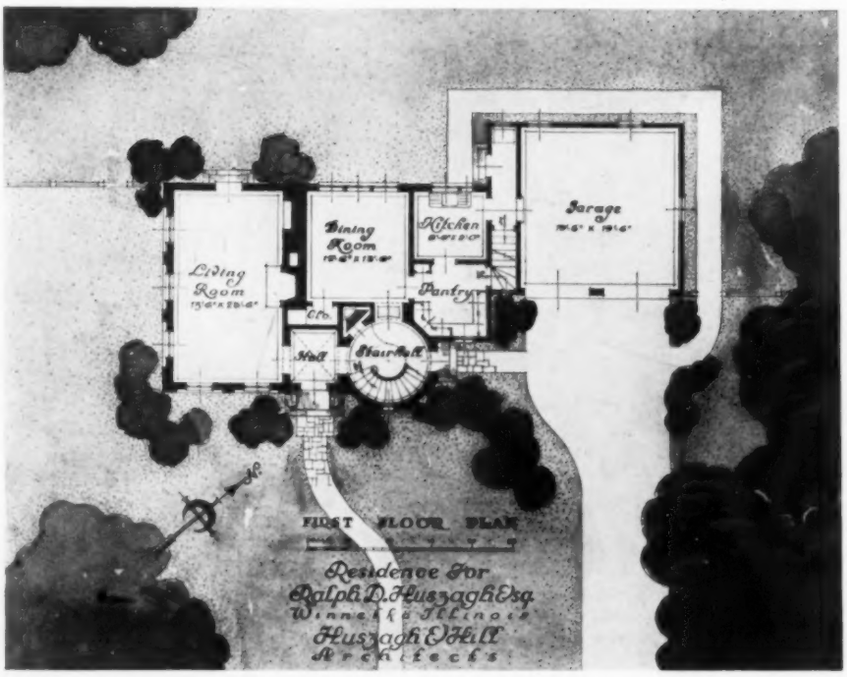


FIRST FLOOR

PLANS. HOUSE OF RALPH D. HUSZAGH, ESQ., WINNETKA, ILL.
HUSZAGH & HILL, ARCHITECTS

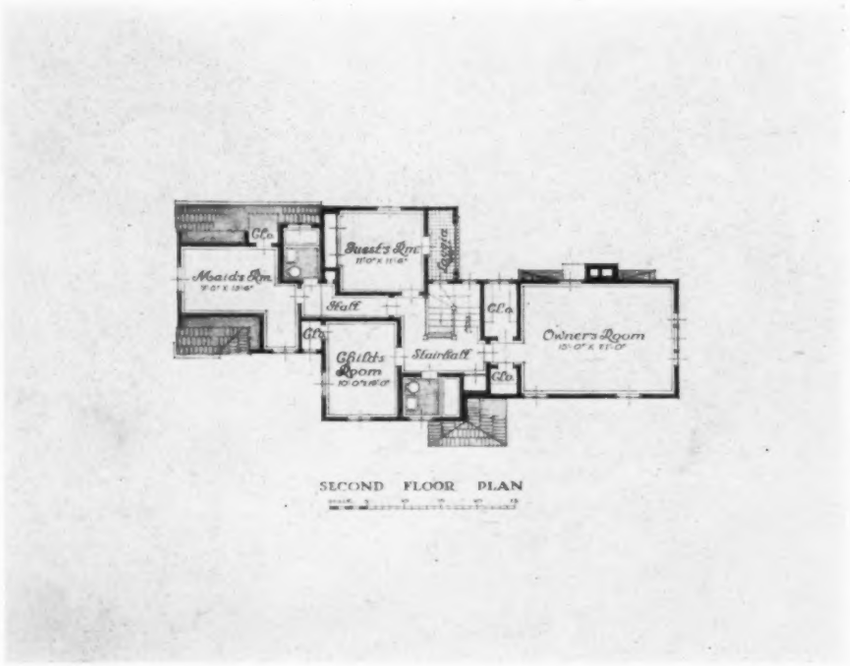
FRONT ELEVATION

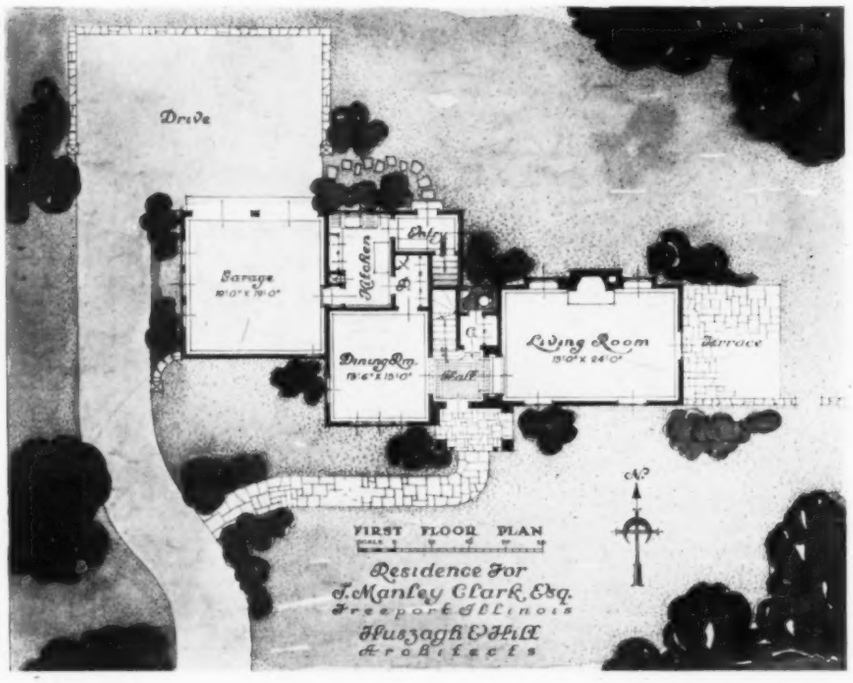
Photos. Trowbridge *Plans on Back*

GARAGE WING

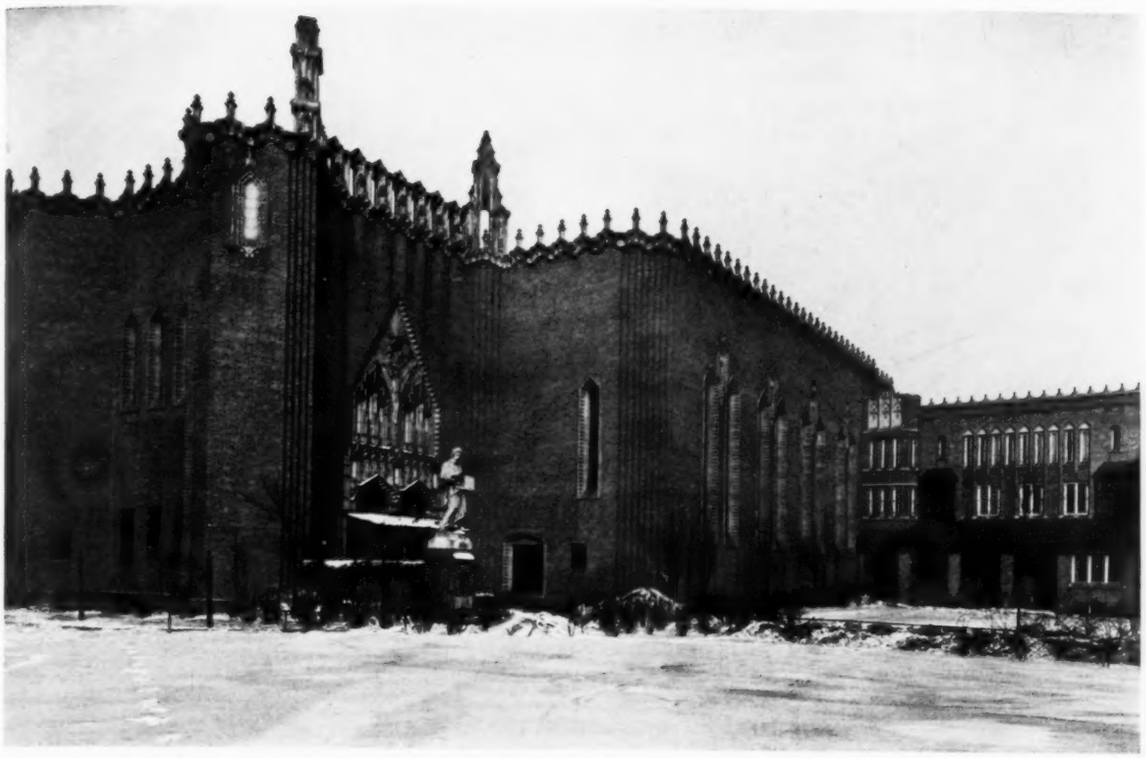
HOUSE OF J. MANLEY CLARK, ESQ., FREEPORT, ILL.

HUSZAGH & HILL, ARCHITECTS





PLANS. HOUSE OF J. MANLEY CLARK, ESQ., FREEPORT, ILL.
HUSZAGH & HILL, ARCHITECTS



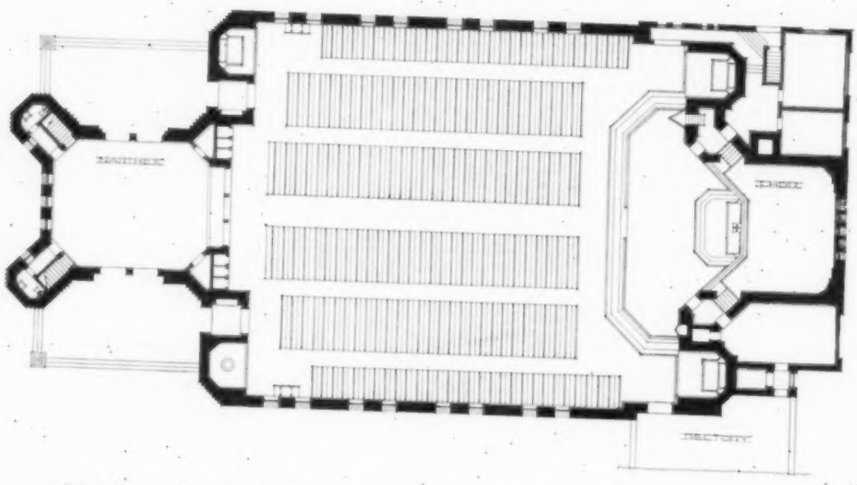
GENERAL VIEW

Photos. Trowbridge *Plan on Back*

SANCTUARY AND SIDE CHAPEL

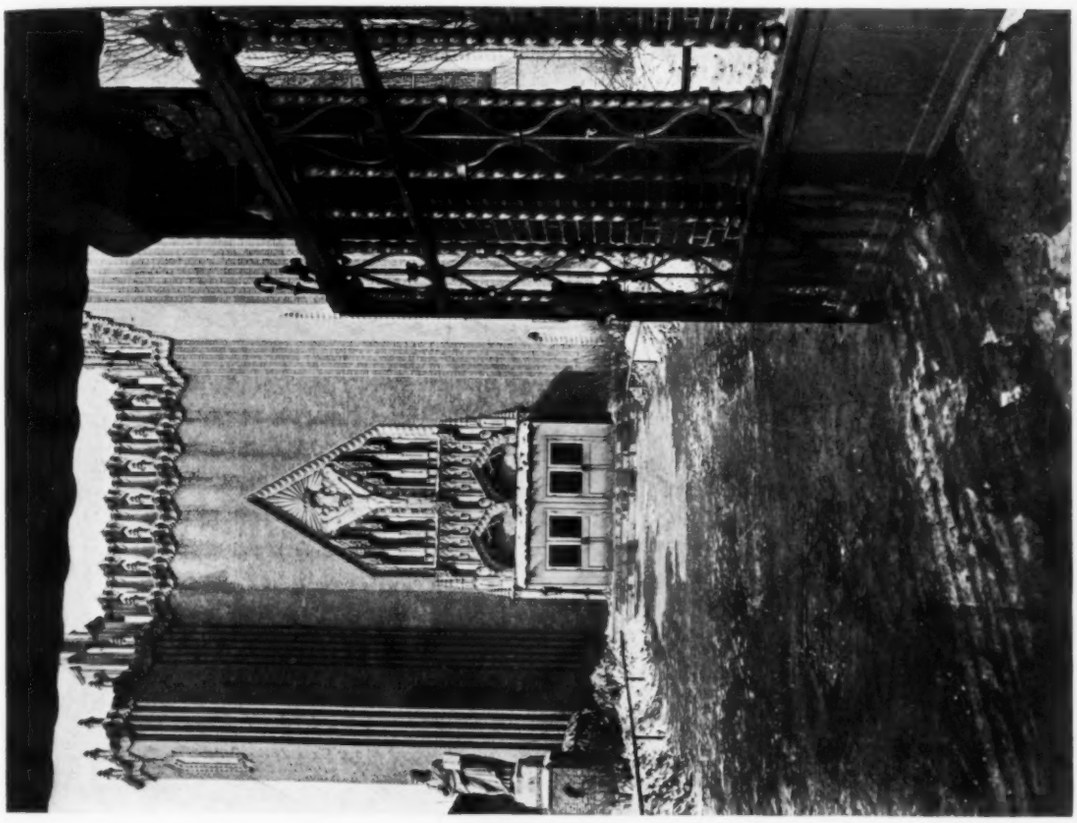
CHURCH OF ST. THOMAS THE APOSTLE, CHICAGO

BARRY BYRNE, ARCHITECT

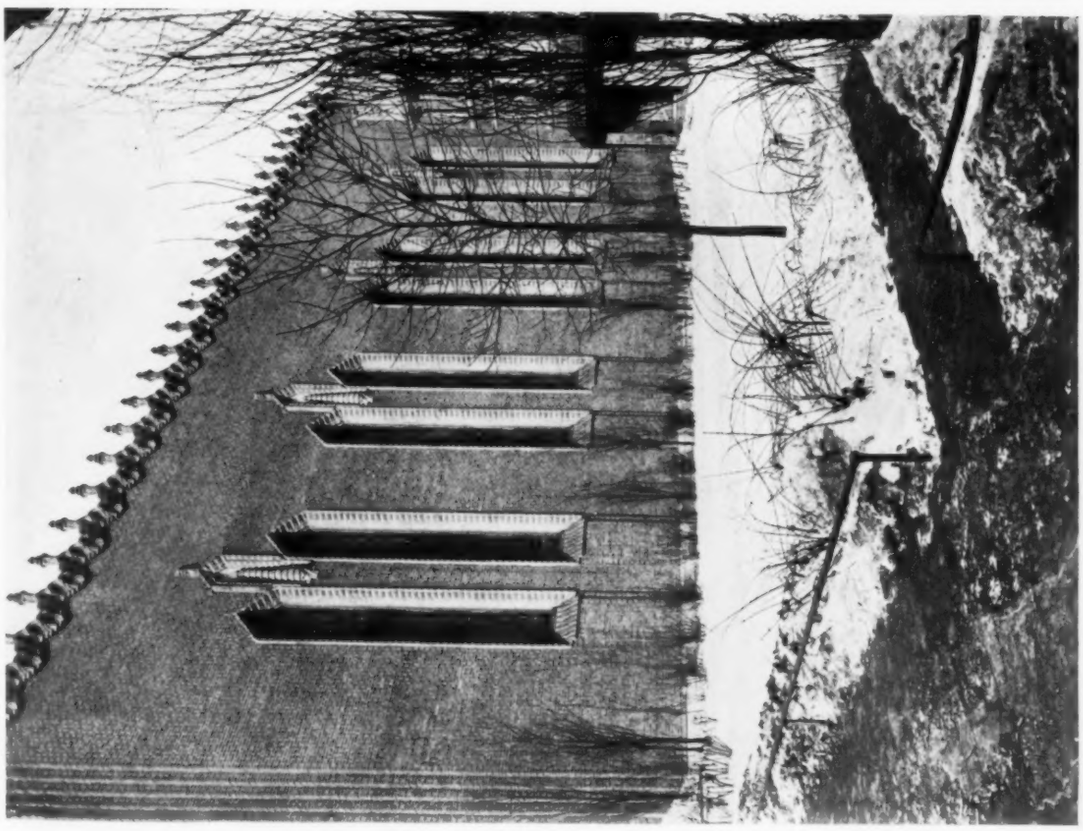


PLAN. CHURCH OF ST. THOMAS THE APOSTLE, CHICAGO

BARRY BYRNE, ARCHITECT



ENTRANCE TO NARTHEX



SOUTH ELEVATION

CHURCH OF ST. THOMAS THE APOSTLE, CHICAGO

BARRY BYRNE, ARCHITECT

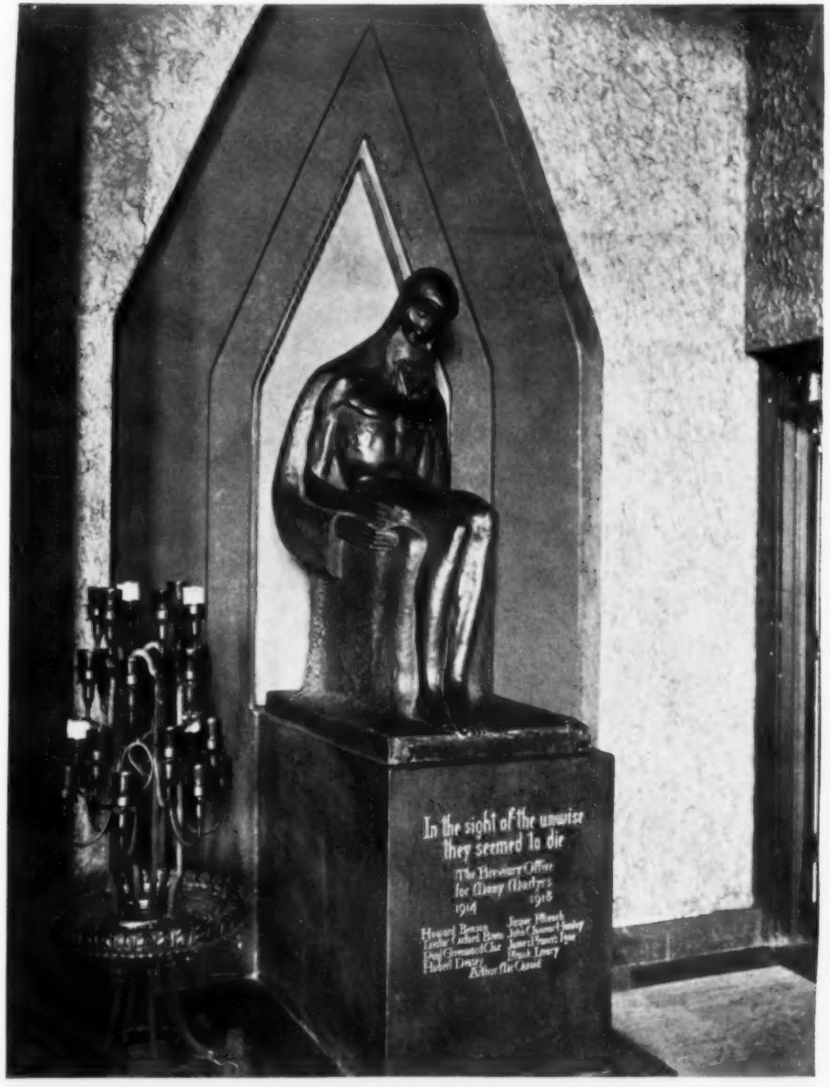
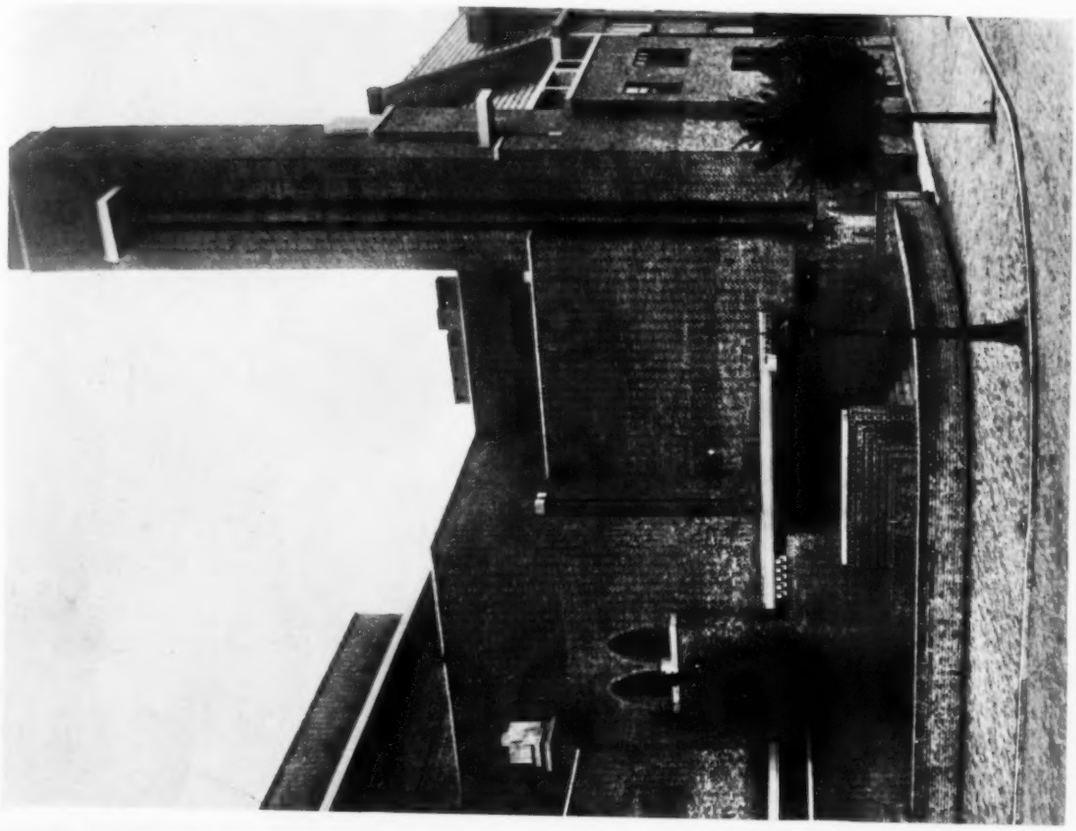


FIGURE IN SIDE CHAPEL

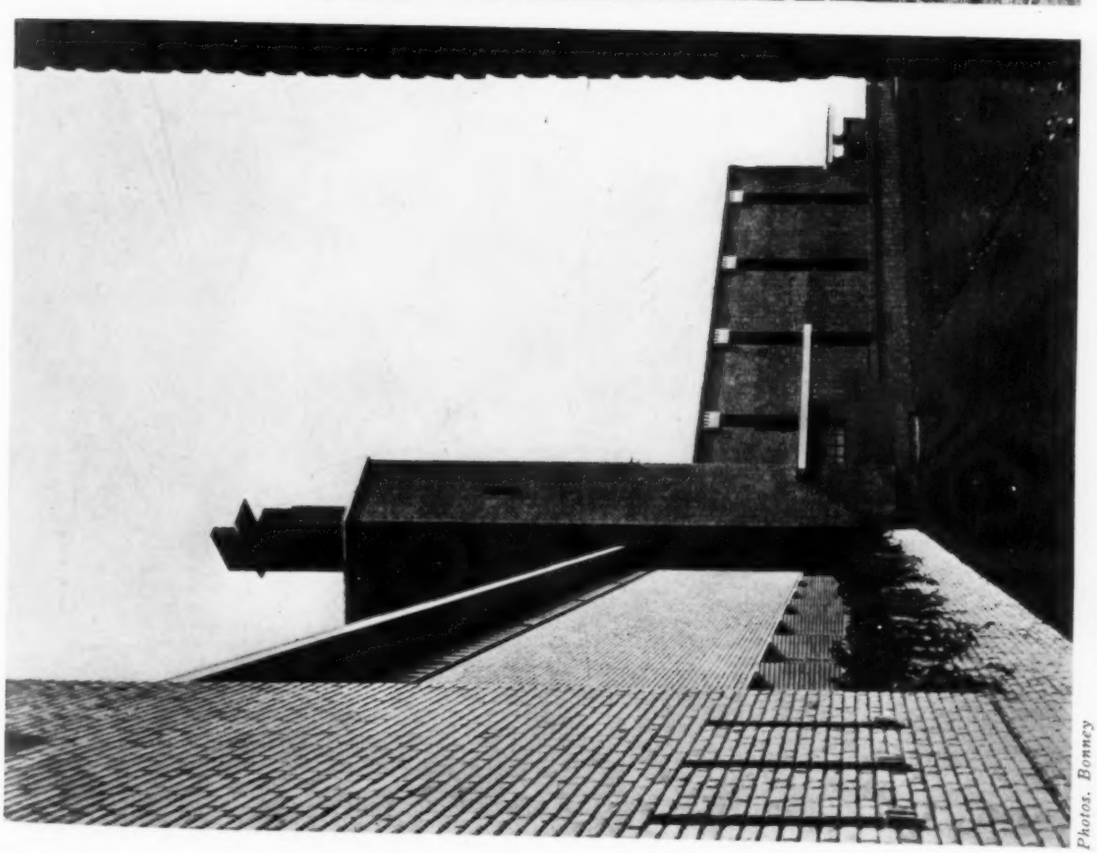
A STATION OF THE CROSS

CHURCH OF ST. THOMAS THE APOSTLE, CHICAGO

BARRY BYRNE, ARCHITECT



SYNAGOGUE AT AMSTERDAM



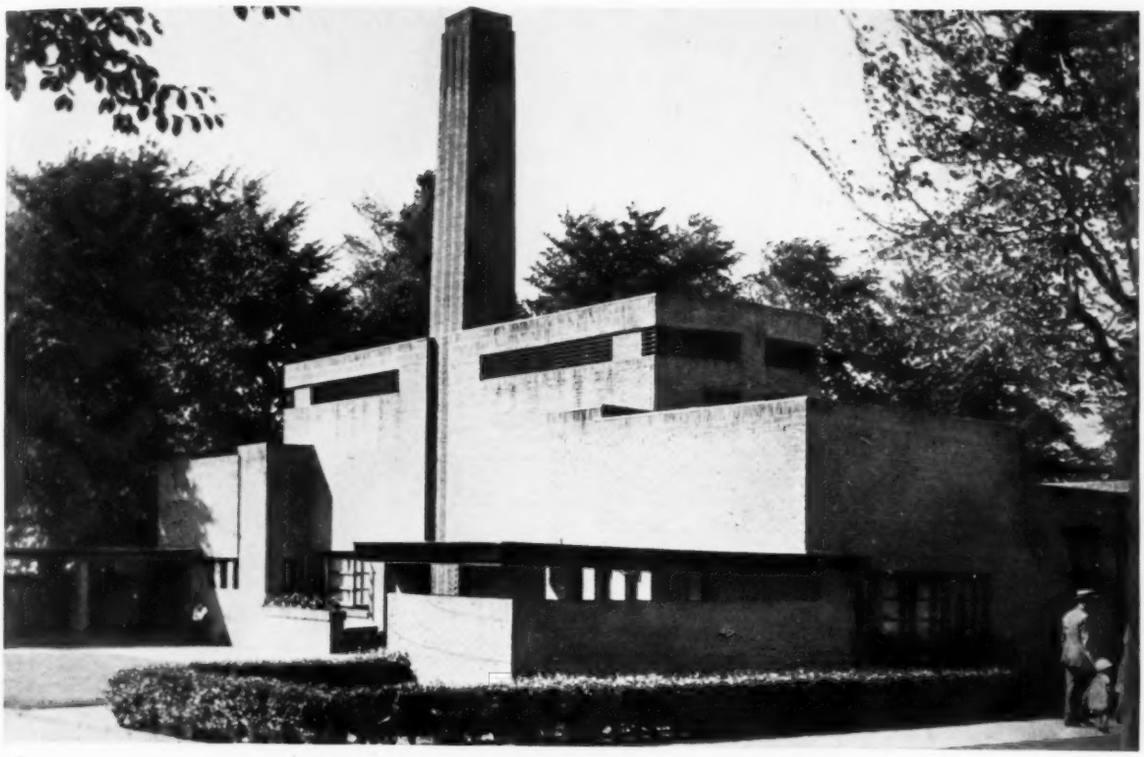
SCHOOL AT HILVERSUM, HOLLAND

Photos. Bonney

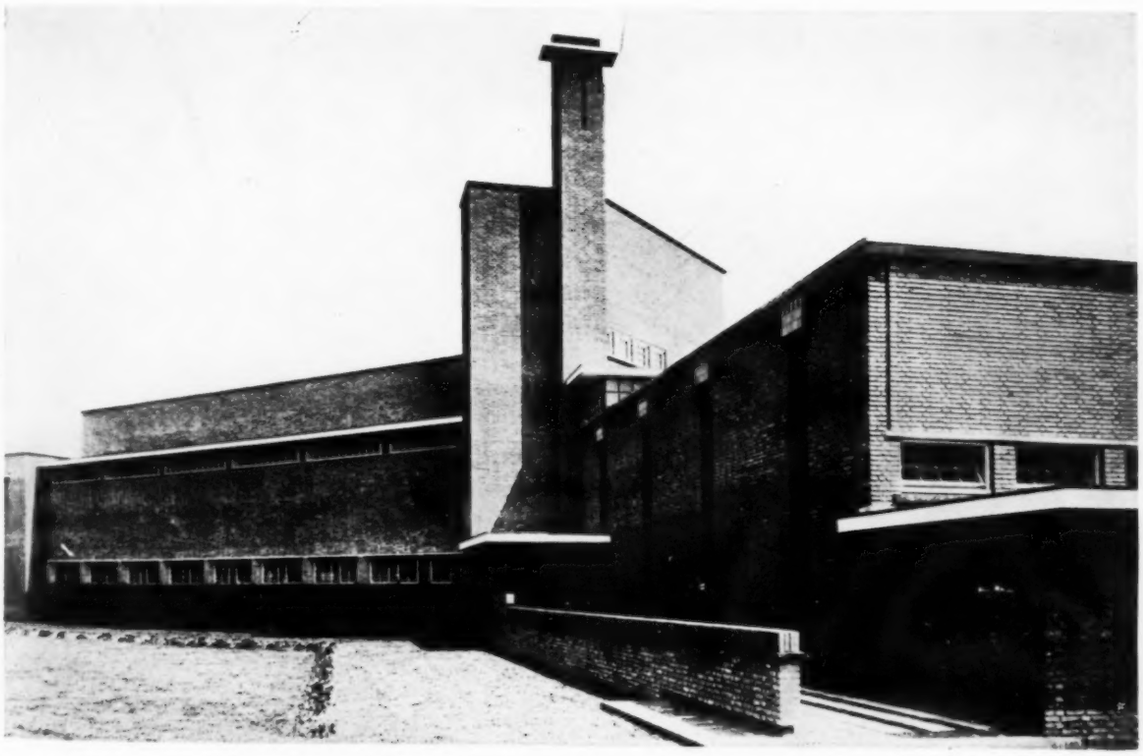
POST OFFICE AND APARTMENT HOUSE AT AMSTERDAM
DE KLERK, ARCHITECT

CHURCH AT THE HAGUE
KROPHOLLER, ARCHITECT

POST OFFICE AT AMSTERDAM
DE KLERK, ARCHITECT



BATH HOUSE AT HILVERSUM, HOLLAND
DUDOK, ARCHITECT



SCHOOL AT HILVERSUM, HOLLAND
DUDOK, ARCHITECT

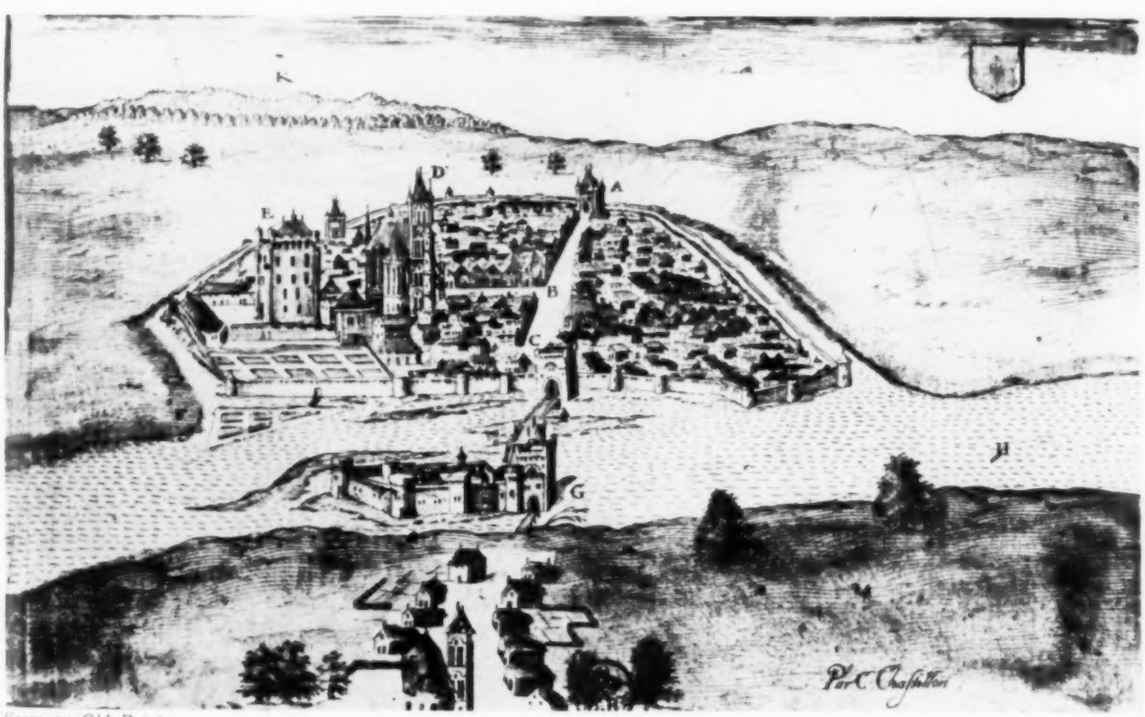
PRIEURE DE PONTLOUP, MORET-SUR-LOING

BY

MILTON D. LOWENSTEIN

THE staunch, mellowed walls of Moret's houses rise above the verdure drooping from crumbling ramparts and trailing incontinently into the waters of the Loing. Where the river rushes from the Forest of Fontainebleau, ivy and willow shoots compete in hiding new romances or suggesting romances which are old! Amiable matrons and giggling girls paddle their laundry on the stone-lined bank while exchanging pleasantries with artists sketching on the opposite shore. Halfway across the stream, partially supported by an old bridge, a deserted mill offers mute encouragement to the whims of fancy and tempts the eye upstream to the *donjon* of Louis VII's old castle peeping over the tops of aging willows. Where the sturdy bridge of Saintloup, or Pontloup as it is called, leaves the shore, a heavy watch tower, the sole remains of the twelfth century defences, performs the duty of town gate and bridgehead. Towering above this scene, the old cathedral occasionally gives out the deep-throated lament of neglected age.

Caesar's commentaries mention a certain Gallic king by the name of Moritus who reigned in a kingdom which later was joined to that of Syagrius. Eight hundred years later the archives tell of an abbot, Loup. He was chosen by Charles-le-Chauve to succeed the treasonable Odon. The first meeting place selected by Loup for the bishops of his neighborhood was Moritus. As the differences between barbarian and Roman became less pronounced, a common language made "Moritus" into "Moret." Until 1081 the town formed the northern limit of the Duchy of Burgundy. Philip I then obtained Moret from Robert the Elder, his uncle, Duke of Burgundy, in exchange for some islands in the Seine. A hundred yards from the eastern end of the old bridge and now jutting into the road leading to Vezelay, are the ruins of a priory built even earlier than the venerable town cathedral. According to a map in the archives at Melun, all the territory that bounded the river outside the town walls once belonged to the monastery of Pontloup. The lands were held in fief to the king, who maintained control through the usual *baillis*. The support which royalty gave brought a prestige that increased the popular demands made upon the monastery. The monks had to add to the offices of the church certain secular duties. Eventually, specialization promoted the rise of orders in which monks were trained for limited activities. The Order of St.



From an Old Print

Prieure De Pontloup in Foreground

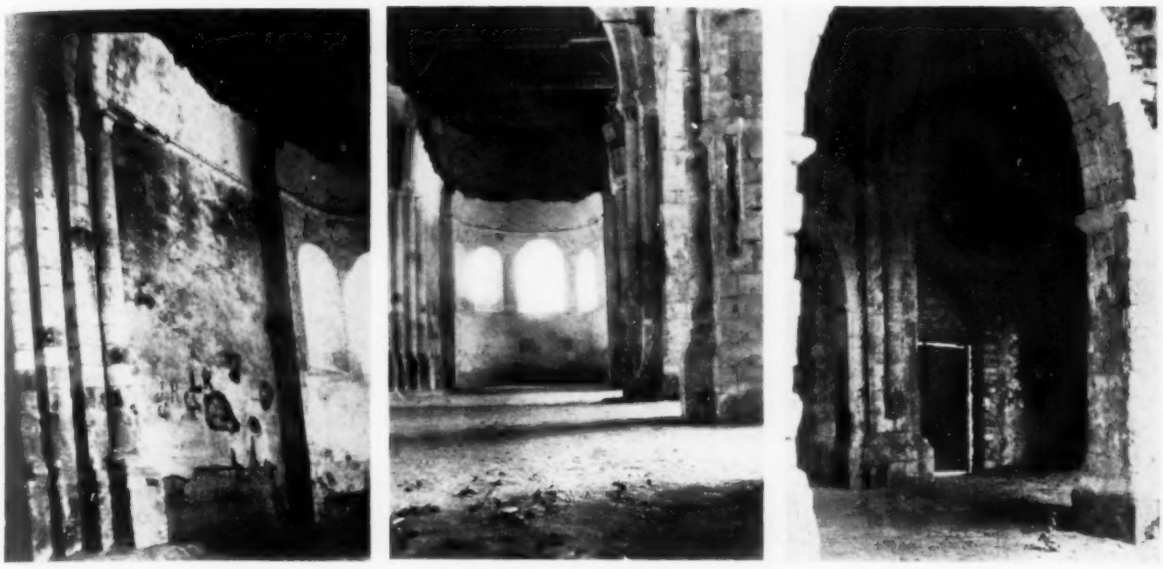
Church of the Prieure De Pontloup, Moret-sur-Loing

Lazarus was given the exclusive right to construct a hospital outside the walls of Moret, a hospital in connection with the Prieure de Pontloup.

In the archives of the Benedictine abbey of St. Madeleine at Vezelay, there is a mss. by Hugues of Poitiers entitled *Historia Vizeliacensis Monasterii*. It appears to have been written between 1156 and 1168. The document contains a list of the priors of the dependent Prieure de Pontloup, but with no clue to the date of its actual foundation. The first prior named is Hugues. He is also mentioned in connection with a quarrel which took place during the time of Pope Eugenius III (1145-1153) between the abbot, Pons de Montbloissier, and the Bishop of Autun, Henry of Burgundy. A monk of Vezelay who witnessed the subsequent inquest also writes of Hugues, the Prior of Moret, as having conducted the monk to Auxerre where the Abbot of Ambry (Albericus) was ordained *sous-diacre* by the Abbot of Pontigny. The latter held office from 1113 to 1136. The Prieure de Pontloup must therefore date from before 1136, the date of Louis VII's ascending the throne. Shortly after this event, the Count of Chalons massacred the monks of Cluny, and the Count of Clermont ravaged the church at Clermont. Louis retaliated by confiscating part of their lands and giving them to his friend, the Count of Nevers. The latter, taking advantage of the king's embarrassment over the divorce of Eleanore of Aquitaine, attempted to seize the monastery at Vezelay. Some of the monks fled to Paris to petition the harassed monarch, and a number sought refuge at the Prieure de Pontloup.

The priory was the logical and æsthetic architectural expression of western culture. Without achieving total severance from architectural tradition, the priory's style developed under the influence of indigenous forces. Local prejudices found expression in important features of construction. The redundancy and inadequacy accompanying the use of unfamiliar forms is confined to the details. The plan of the priory church shows three aisles, each terminating in an eastern apse. The bays of the center aisle are oblong, while those of the side aisles are approximately square, as is also the crossing. The steps which extend across the middle of the nave and aisles mark approximately the junction of the original twelfth century construction and what was added later at various times. The nave vaulting is supported on piers, each of which has an engaged column on the nave side and extends to just below the sill of the clerestory windows. The two piers bounding the west side of the crossing have engaged columns on the transept sides as well. Short and stalwart, they bear a better relation to the arches they support than do the more attenuated columns in the western end of the nave.

Except in the south wall, which has been replaced by a modern rubble construction, there remain portions of all the original exterior walls and their buttresses. From the disposition and size of the latter it was possible to make a restoration of the tower and the transepts. The exterior of the apses does not attain to that perfect roundness found in examples more dominated by classical influence. The central apse tends to be a polygon, the angles of which become rounded as the roof is approached. The two small apses are rounded externally a short distance from the ground; above they are corbeled out to a rectangular form in order to receive a lean-to roof. In plan, both small apses turn away from the central



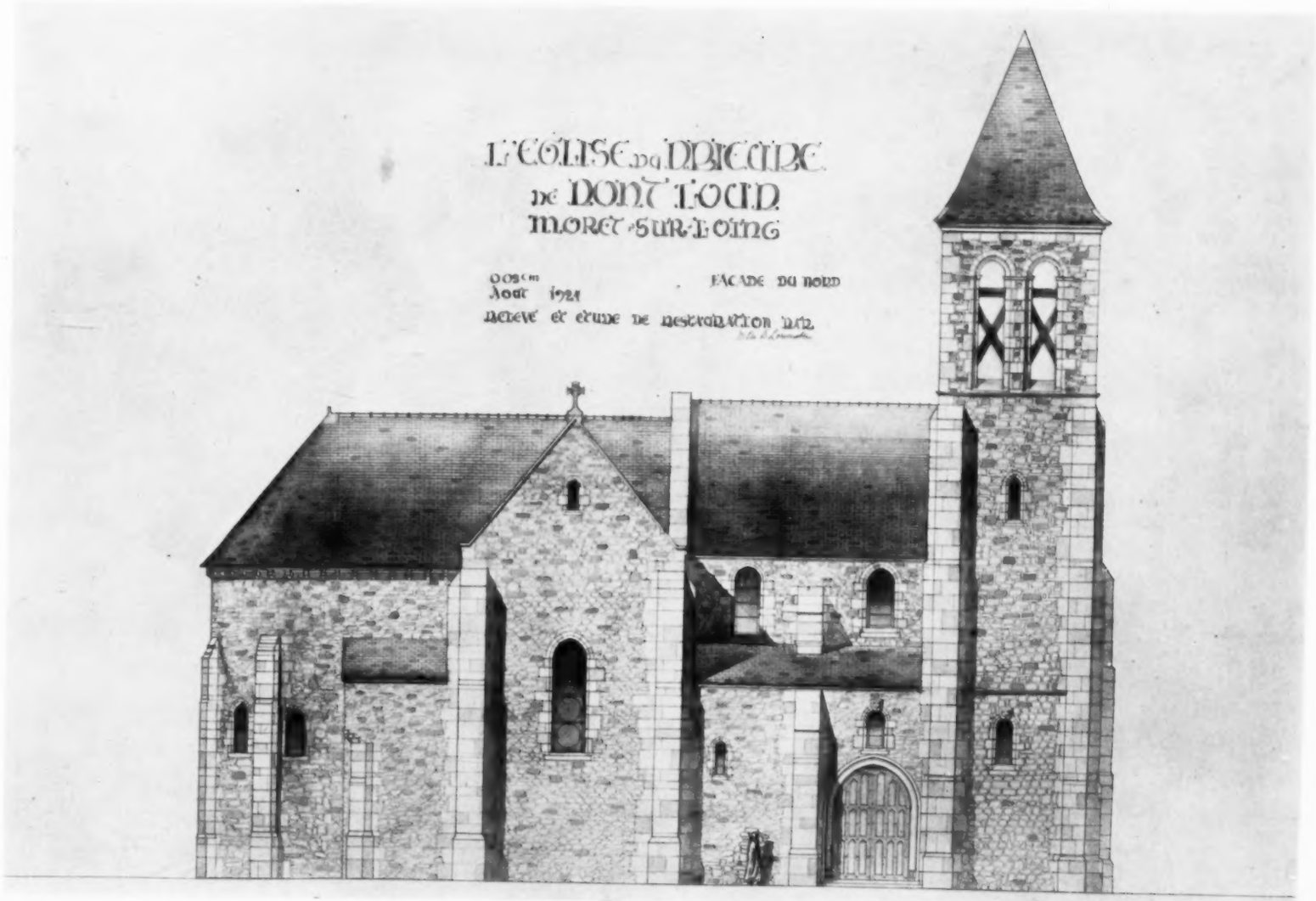
Church of the Prieure De Pontloup, Moret-sur-Loing

apse, and the thickening of the walls at the junction of the apses allows support for a barrel vault over the choir.

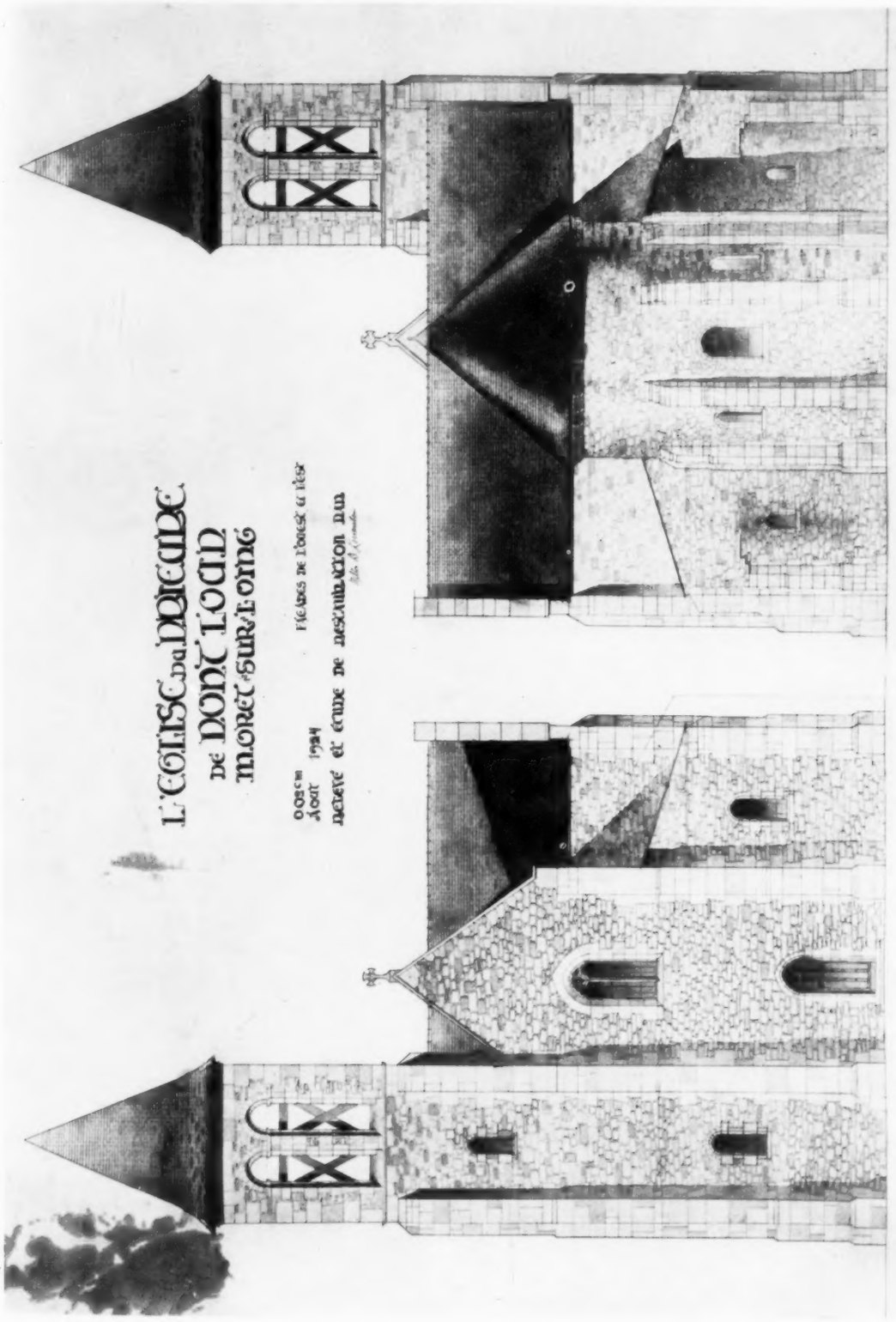
Most of the groined vaulting of the north aisle is still in place. It is supported on pilasters of the north wall and on the nave piers. No transverse ribs connect the pilasters or the piers. They are used only from pier to pilaster. All the groins have semi-circular profiles. This brought the key of the vault higher than the keys of the transverse arches. The latter, therefore, had to sustain the thrust of the sloping vault sections. In the center aisle where the oblong bays would have made the difference in elevation excessive, the wall arches were pointed over the clerestory windows, though only traces in the clerestory wall remain to indicate this fact. These vault intersections are evidence of there having been groined vaulting over the center aisle. This was seldom attempted in any but the smaller churches,—Issy-l'Eveque (Saone-et-Loire), Pontaubert-et-Sacy (Yonne), etc. More examples are found in the south,—Chambon (Creuse), where no transverse ribs are employed. The influence of Cluny and Citeaux brought the groined vaulting of the nave to Laach in 1156, and later to Eberbach and the cathedral of Speyer and Mainz. But its unwieldiness and the lack of any great need for light precluded its adoption in Burgundy and Auvergne, where its use was reserved for the side aisles.

As seen on the north elevation, buttressing was used to strengthen the clerestory wall. There are no examples in this neighborhood of the transverse barrel vaults over the nave such as were used at this time in Tournus and which obviated the necessity of having buttresses and at the same time allowed ample room for clerestory windows. The system of using the transverse vaults of the side aisles to buttress the nave vault, employed extensively in Perigord and Anjou, is not found farther north than St. Pathus. The ribbed vaulting over the transept crossing has ogival transverse ribs. By eliminating most of the slope from the vault sections, they are able to transfer all the thrust to the piers. The ribs are rectangular in section and stepped out to receive the vaulting material. The diagonal ribs spring from corbels. These span the reëntrant angles of the abacus which is continued between the capitals as a string course. Their section consists of two three-quarter rounds separated by a wide arris.

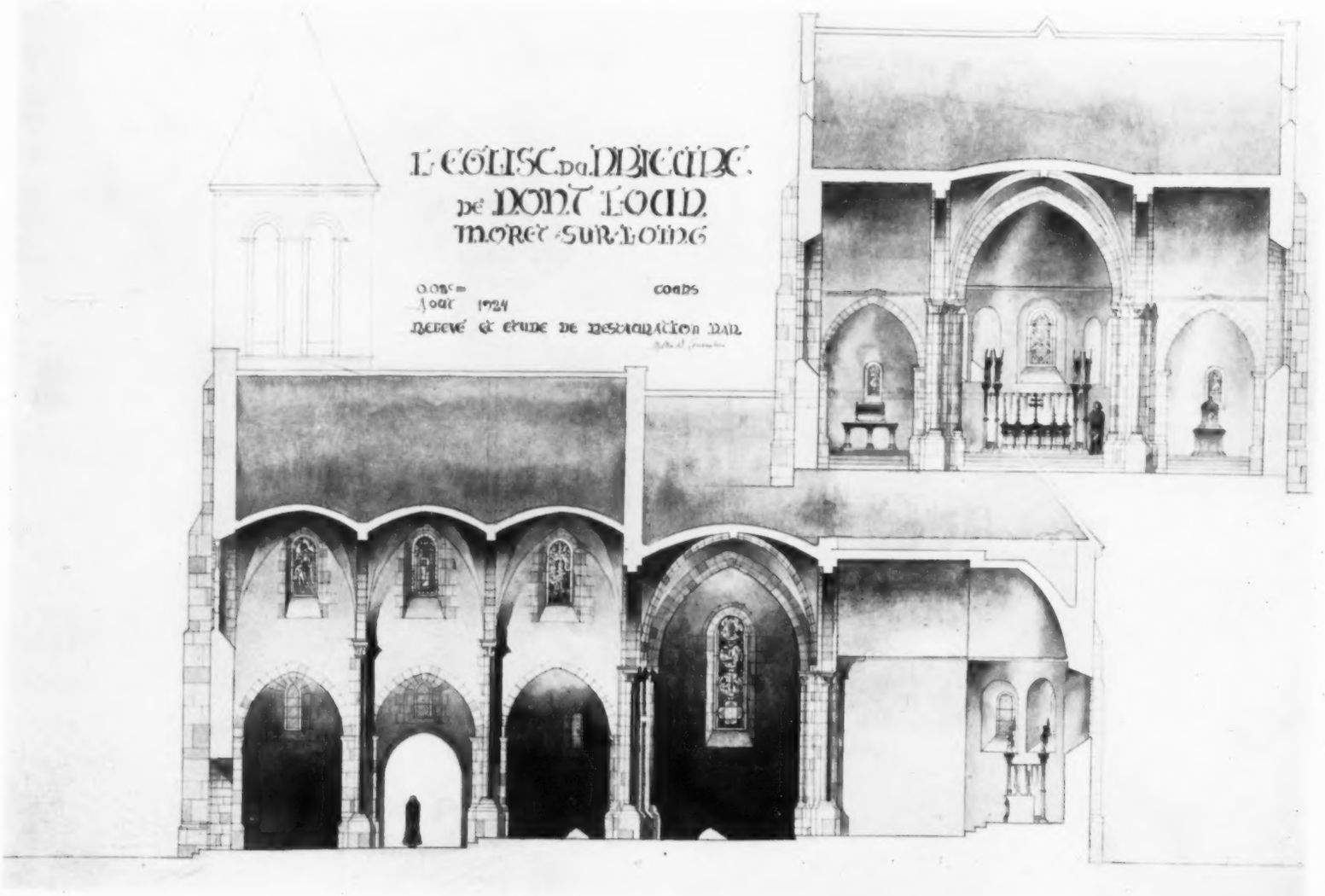
Simplicity rather than severity characterizes the capital and base design. The leaves forming capitals are reminiscent of Egyptian palmettes and are not mere scratches but mould the surface of the block. They have a suggestion of veining and texture, and as they sweep gracefully out from the capital-torus, they seem as far away from the superficial Merovingian ornament as from the obdurately conventional classic. Though the bases are heavy, the proportioning of the elements is such that the column is given a feeling of elegant solidity. There are uncarved knobs between the torus and the plinth. All the capitals and bases, as well as the alternate courses of the columns, have tenons built into the wall. The window jambs and sills are splayed in order to shed water and to facilitate lighting. There are examples in the neighborhood where, to prevent the water from running over the inside walls (or, as a French archæologist suggests, to prevent the dust showing), the inside sill is cut into steps. The voussoirs of the priory windows follow the plan of the sill and contain no carved ornament inside,



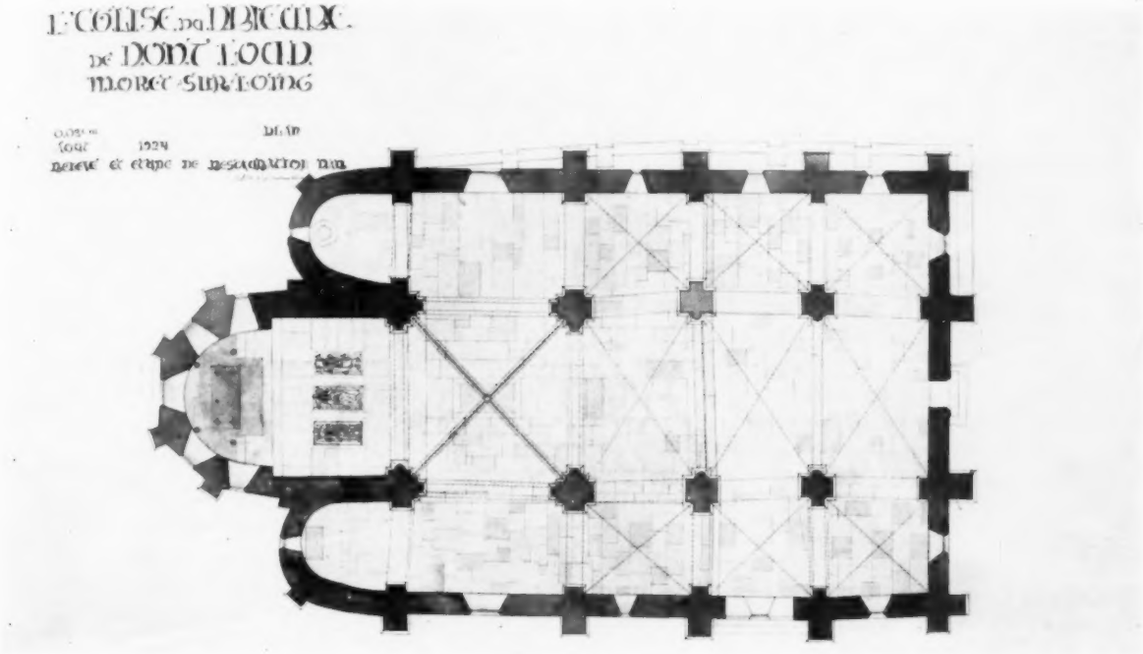
RESTORED NORTH ELEVATION
CHURCH OF THE PRIEURE DE PONTLOUP, MORET-SUR-LOING
FROM A MEASURED RENDERING BY MILTON D. LOWENSTEIN



RESTORED WEST AND EAST ELEVATIONS
CHURCH OF THE PRIEURE DE PONTLOUP, MORET-SUR-LOING
FROM A MEASURED RENDERING BY MILTON D. LOWENSTEIN



RESTORED CROSS AND LONGITUDINAL SECTIONS
CHURCH OF THE PRIEURÉ DE PONTLOUP, MORET-SUR-LOING
FROM A MEASURED RENDERING BY MILTON D. LOWENSTEIN



PLAN. PRIEURE DE PONTLOUP, MORET-SUR-LOING
FROM A MEASURED RENDERING BY MILTON D. LOWENSTEIN

MARKINGS ON TOMBS AT ST. MAMMES
FROM MEASURED DRAWINGS BY MILTON D. LOWENSTEIN

and (except in the western part of the north wall, which has the king's coat of arms) none outside.

The windows in the eastern or older part, are small and round headed, as well as is the window in the north wall of the first bay after the transept. The clerestory windows are slightly ogival and belong to a construction period later than does the apse. A study of the mouldings on the north door indicate that it was built in the latter part of the fifteenth century. Fenestration at the west end of the nave and at the ends of the transepts was usually treated by grouping two or three windows together. But in small churches the better practice was to keep a single window and to harmonize the composition with the clerestory. The restoration shows this treatment.

The tower is indicated as being square, following the design as seen in a seventeenth century wood cut. The style is that of the earlier part of the priory. It was probably vaulted at each of the floor levels. The use of glass was confined to the lower floors, and the openings in the belfry were made as large as possible. Here were hung the chimes which were removed in 1791 and sent to the mint in Paris. The tower roof was supported on wooden trusses and covered with slate. A metal ball usually surmounted the peak and contained relics to give protection against lightning. A wooden beamed ceiling might at first have covered the entire nave of the priory. When it was replaced by the groined vault, the wood-framed roof was retained. Instead of using the kingpost construction of antiquity, the roof trusses were formed into a letter "A" into which were let the longitudinal beams. The rafters were extended to the outside edges of the walls. That part of the roof which projected was carried by plain, heavy corbels on the eastern part of the priory, and upon a continuous string course on the newer western part. This entire superstructure of wood served as an "architectural umbrella" for the vaulting underneath.

Though no trace of it can now be found, painted decoration was added from time to time on the interior walls. Its style in the twelfth century must have possessed that piquant virility typical of Burgundian work, tempered by the modest humanism that was permeating the Ile de France. The paintings had neither the ornateness of southern decoration nor the severity of northern forms. Oriental fabrics, chests, ivories, pottery and glass suggested the technique and influenced the style. The subjects were remnants taken from a subtle classic philosophy and broadly interpreted by Christianity into the popular language. Nurtured in the restricted area of a town, these ideas must have developed a distinct local flavor but without sacrificing their folk-art quality with its humanistic common denominator. The so-called barbaric work on painted vases made in Greece in the century VIII B.C. would make an interesting comparison with objects in this "Romanesque" style.

By the end of the thirteenth century monasticism had lost its force as an instrument of the king. By a gradual introduction of Roman civil law, Philip IV abrogated all local authority. He excluded ecclesiastics from office in the parliament formed in 1287, and in 1307 the Knights of the Order of Templars were arrested on various charges of heresy, and their property was forfeited. Guillaume de Noyers, the third prior of the Prieure de Pontloup, who entered office in 1383, cites an indication of monastic decadence in his account of the war between John the Good and Charles, King of Navarre. "Owing to the fortunes of war," he writes, "the buildings and other resources of the priory were considerably reduced." One can understand the confusion of the time when destruction wrought in 1359 was not yet repaired in 1383.

It was not until the end of the fourteenth century that the western part of the priory was rebuilt. The stereotomy of the base and lower courses corresponds with that of the eastern part and indicates that the original priory church occupied the entire site of the present building. The reconstruction included everything west of the transept. It is difficult to explain the portion of a partition which extends across the junction.

The prior lived at Vezelay and rented *"la recette generale du revenu temporal"* to agents who received a part of the tithes collected from the old mill and what little remained of the other feudal holdings. The religious fanaticism of a passing dynasty interrupted the process of deterioration to effect a further restoration. Among Henry II's chivalric gestures are the heraldic emblems carved on the window lintels of the north wall. In 1747 the seminary of Sens, which had annexed the priory, proposed to demolish it. But two old monks who were acting as caretakers succeeded in moving the town authorities to oppose the project on the grounds of sacrilege. Even after the revolution the crumbling walls still guarded some of the original relics,—a fragment of the altar and the chimes. Neighboring towns bid for the spoils. One of them, with a church of approximately the same period, secured the altar. The national government intervened when it came to the question of the chimes, and they were claimed for the mint in Paris. The reliquary, the design of which is suggested in the section, went to the town cathedral. This legitimate destiny, however, did not save the relics themselves from the scruples of enlightenment. In 1858 the bishop ordered the cure of Moret to bury the relics in the cemetery, since no certificates of authenticity could be produced

AND NOW—A "MODERN" HOUSE

BY

R. W. SEXTON

WE are gradually becoming accustomed to "modern" architecture. We find the sharp angles that once disturbed us not at all illogical; strange forms do not seem as eccentric as they once did, and even purely geometrical motifs seem to have an ornamental value that only a few months ago we would never have thought possible. A change from sixteenth century ideas to twentieth century ideas at one sweep is bound to jar us by its very suddenness. But already we admit, to ourselves at least, that we do more work, and get more pleasure out of it, in a modern office building; that we really enjoy a play more in a modern theater, and that we find a meal tastes better in a restaurant designed in the modern manner. But a modern house! Why?

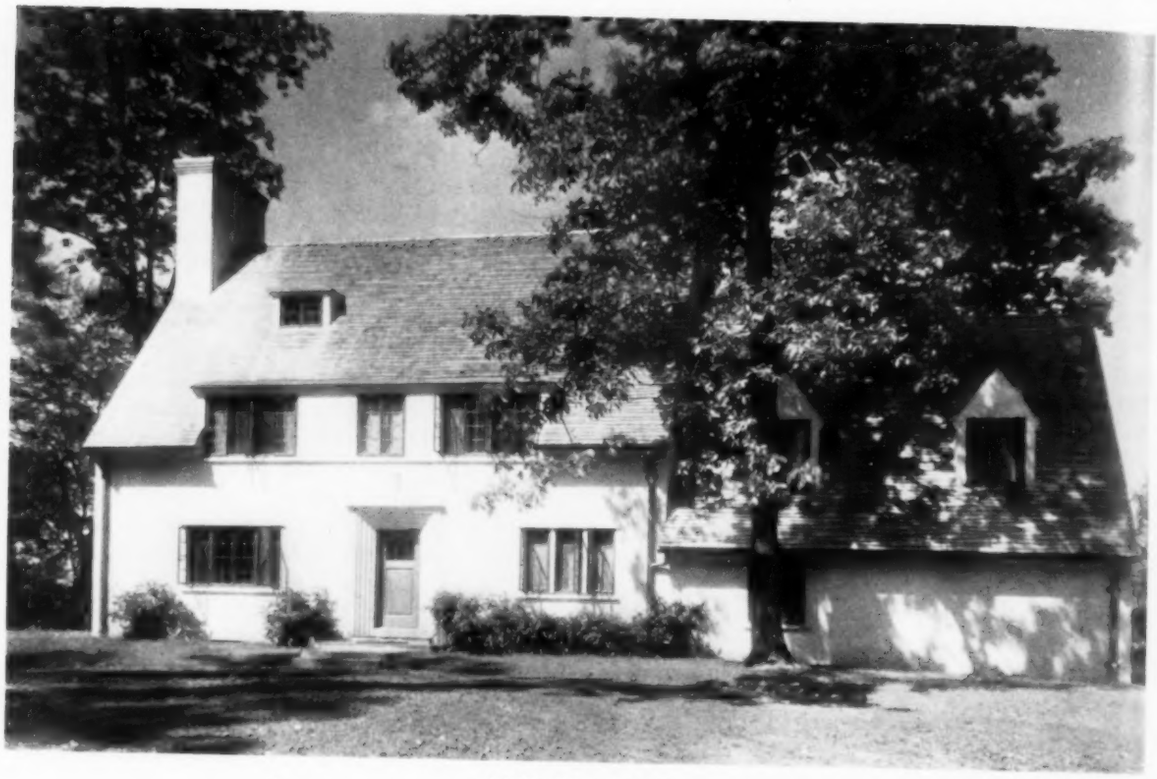
A "modern" house is not a "freak" house (although that is what most people think it must be) any more than a modern office building is a "freak." A "modern" house, after all, is one in the design of which the architect has given expression to his creative ability. Although a house in the modern style naturally suggests that the designer does not follow too closely any one style or period of architecture, it must not be understood that the design of such a house cannot bear certain evidence of the influence of some historic style or period. A house is modern because its plan is developed to conform to the needs and requirements of those who are to live therein; because its design reflects the character and personality of the owner; and because it is constructed of materials which are peculiar to the times and to its locality.

According to this formula, the house of H. L. Hoyt at Great Neck, N. Y., is a modern house. There is nothing radical about the design, and yet it cannot be said of it that it is designed in the style of some historic period. The architect, Julius Gregory, was presented with a modern problem, and a logical solution has naturally resulted in a house that is modern. It is particularly interesting to note that those details of the design which are peculiarly modern in character have been attained by the use of stucco. We so often think that a modern house must be a house constructed of unusual materials. Here is a house of frame construction, with exterior walls of stucco, and yet in many details the design does not follow lines which we have by custom come to associate with stucco. An original design, naturally, to be a good design, must conform at the same time to certain established principles of architecture. One of the most vital of these principles is to retain in the design a character that is in keeping with the material in which the design takes form. It is because Mr. Gregory has applied this principle, while giving expression to his creative ability, that this house at Great Neck is so interesting.

Photos, George H. Van Anda

House of H. L. Hoyt, Esq., Great Neck, N. Y.

Julius Gregory, Architect



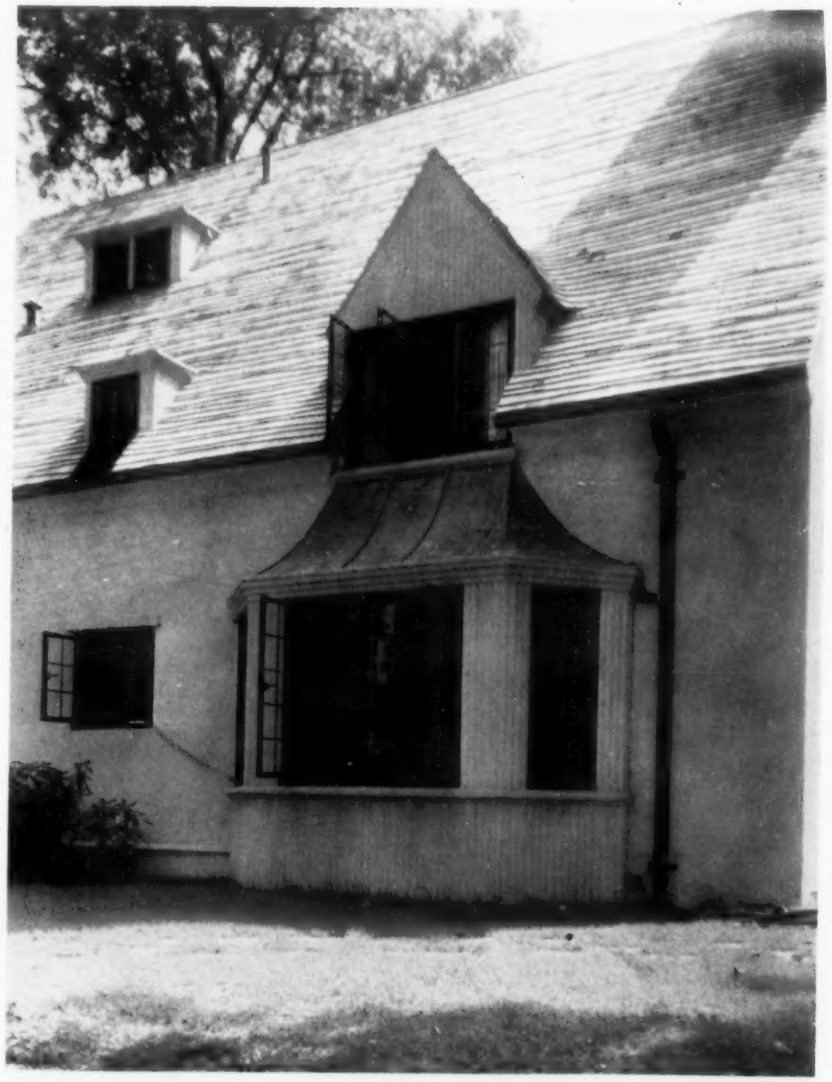
ENTRANCE FRONT

GARDEN FRONT

HOUSE OF H. L. HOYT, ESQ., GREAT NECK, N. Y.

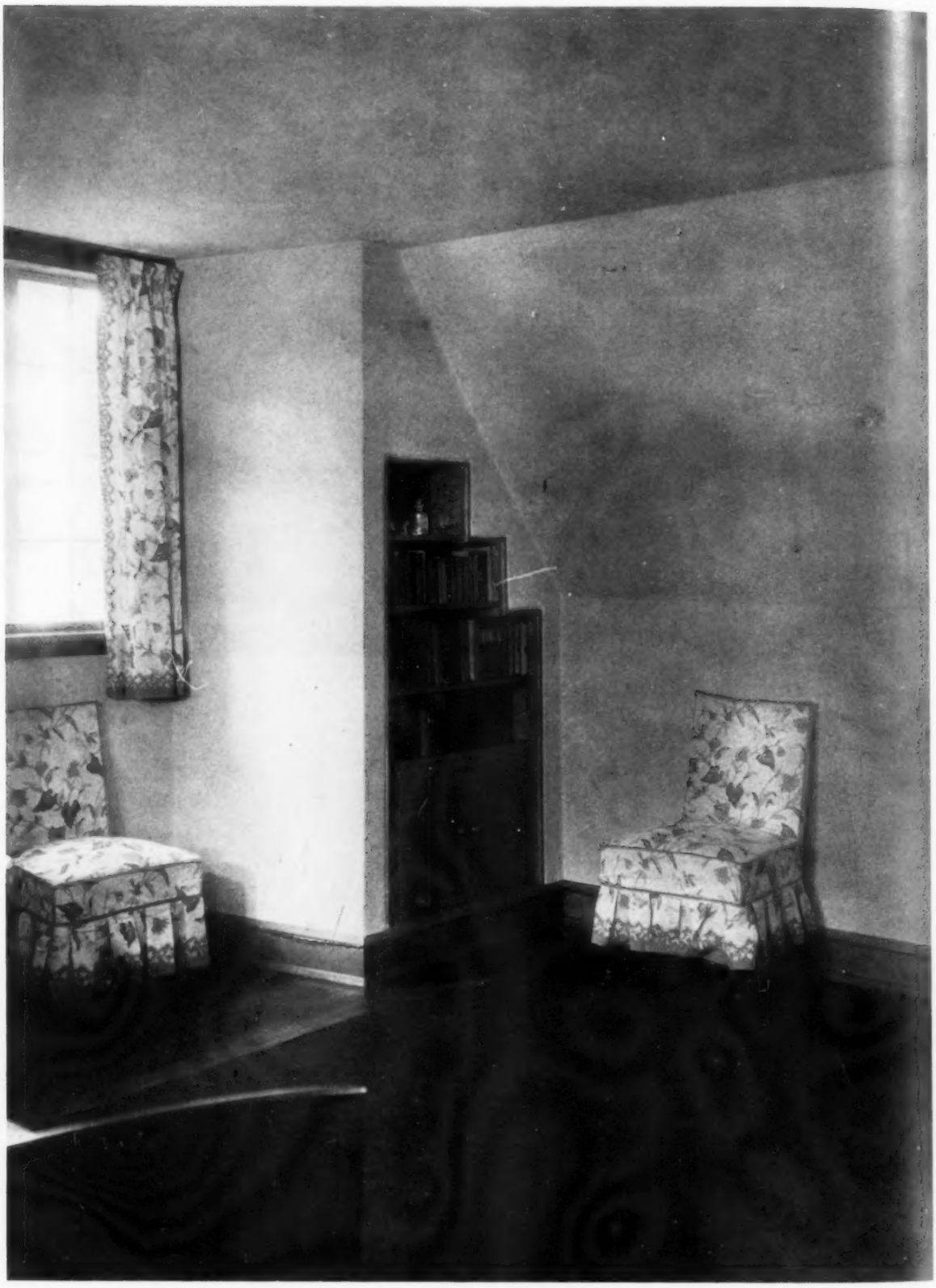
JULIUS GREGORY, ARCHITECT

ENTRANCE DOOR



DINING ROOM BAY

HOUSE OF H. L. HOYT, ESQ., GREAT NECK, N. Y.
JULIUS GREGORY, ARCHITECT



DETAIL IN BEDROOM
HOUSE OF H. L. HOYT, ESQ., GREAT NECK, N. Y.
JULIUS GREGORY, ARCHITECT

THE WYE HOUSE ORANGERIE

BY

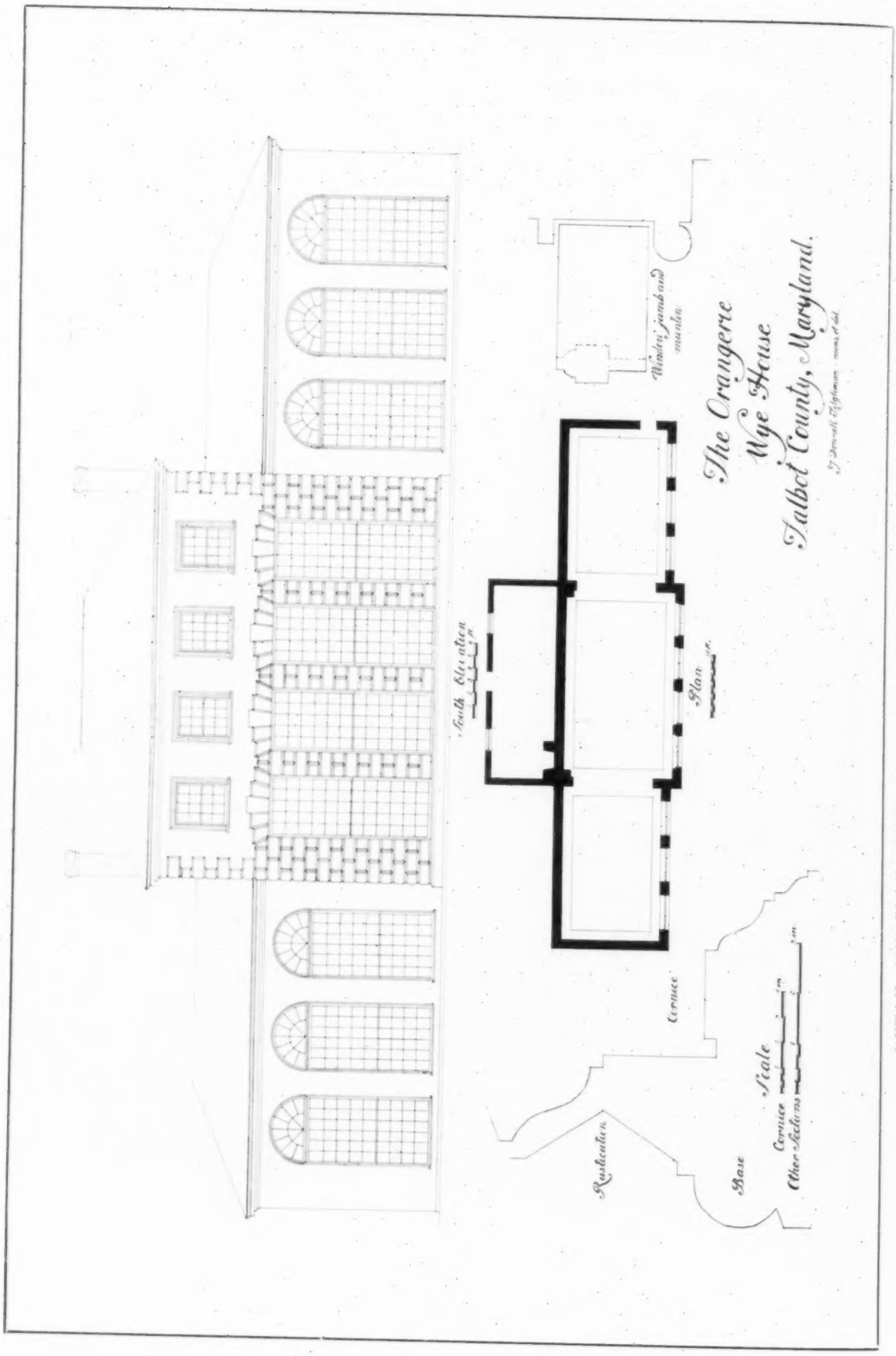
J. DONNELL TILGHMAN

THE orangerie at Wye House, in Maryland, is in all probability the only old example of this type of building in this country. There is no record of the date of its erection, nor is it possible to guess at this with any degree of accuracy, since it is totally different in style from anything else in early American architecture. Wye House itself, of which there is also no definite building date, was constructed some time during the last quarter of the eighteenth century. Traditionally, the orangerie is older, a supposition well borne out by the fact that it is considerably off axis with the house, which it faces across a long bowling green. There is additional evidence that it was part of an earlier garden scheme surrounding the old house, which was partly destroyed by fire.

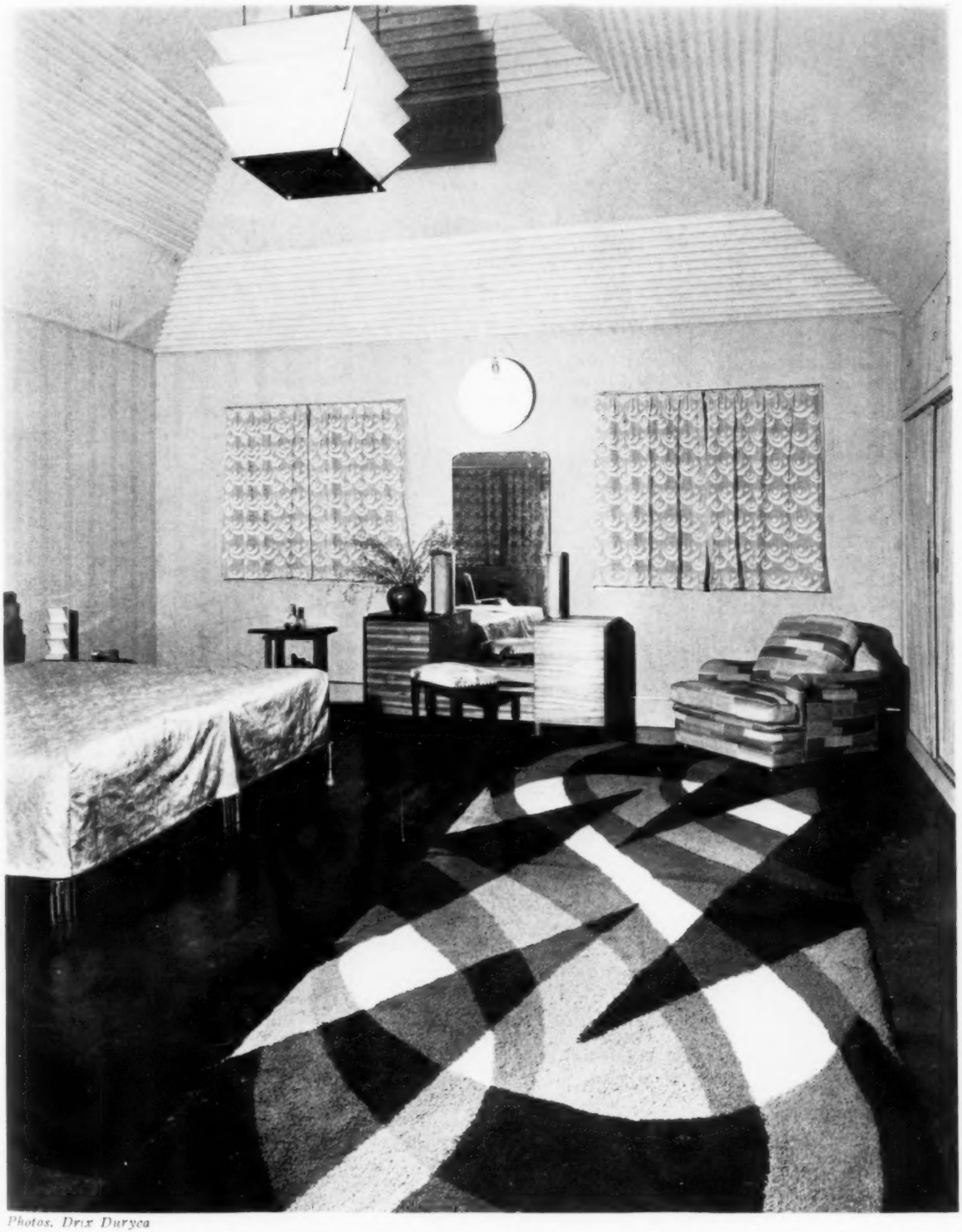
The orangerie is constructed of brick covered with stucco. The quoins are of stone, although the lintels over the windows are of wood carved to represent stone. The roofs are of shingles. In the second story there is a billiard room which still contains the old table, this room being reached by an outside stairway. The low shed at the back contained a furnace that was fired with large sticks of wood. The smoke from this furnace passed under the floor before finding its way out one of the chimneys. Combined with the sunlight, this produced sufficient heat for the raising of citrous fruits. The building, in the memory of people still living, was used as an orangerie. Both orange and lemon trees, planted in tubs of almost exactly the same design as those still used at Versailles, were kept in the orangerie in cold weather, and were set about the garden during the summer months. Enough fruit was raised to supply the household.

The Wye orangerie, which is as beautiful as it is unusual, is the focal point of one of the most extensive and beautiful American gardens that date from the eighteenth century. Unfortunately, the accompanying illustration shows no part of the gardens. A broad lawn flanked by tall shrubbery and trees forms the simple setting of this interesting and unusual bit of architecture. It is interesting to realize that even in this country prior to 1800 great mansions and estates were built by the rich and distinguished Cavalier families of the south, homes rivaling in beauty and importance the work being done in Georgian England at that time. The care shown in the study of this design is characteristic of the architectural work of this period. The windows are well proportioned and in splendid scale. Not only the small, square windows of the billiard room on the second floor, but also the many small panes emphasize and indicate the unusual size of the great windows of the first story.

The Orangerie, Wye House, Talbot County, Md.



DETAIL AND PLAN: THE ORANGERIE, WYE HOUSE, TALBOT COUNTY, MD.
FROM A MEASURED DRAWING BY J. DONNELL TILGHMAN



Photos, Drix Duryea

Guest Room, House of James L. Breese, Esq., Southampton, N. Y. Architecture and Furniture by Herbert Lippmann. Decorations by Francis T. Miller, Inc.

Architectural Treatment. Ceilings: Natural Gray, Plain and Corrugated Asbestos Material; Ceiling Made Into Truncated Square; Plain Pyramid Under Slope of Roof. Walls: Covered with Natural Colored Patterned Jute. Windows and Doors: Chromium Plated Brass Bars Around Windows and Doors and Above Base, Jute Nailing Covered by These Bars; and on Doors Themselves. The Jute Ends Also are Covered by Chromium Plated Brass Angles. Flooring: Three Shades of Cork Composition Tile with Narrow Borders and Field Designed Paralleling Beds. Mirrors have Monel Metal Frames and Ground Glass Below to Provide Lighting. The Wood Shelves are Lacquered Black.

Guest Room, House of James L. Breese, Esq., Southampton, N. Y. Architecture and Furniture by Herbert Lippmann. Decorations by Francis T. Miller, Inc. Furniture: Beds, Separate Head-board Hooked to Wall, Veneered with Tamo, Walnut and Macassar Ebony; Bed Frames of Standard Brass Angles and Round Bars, All Chromium Plated. Woman's Dresser, with Mirrors, Lights, Drawers, Tray; Veneered with Zebra Wood and Rosewood, No Projecting Drawpulls, Finger Grooves in Scalloped Pattern on Edges of Drawer Fronts. Man's Dresser, with Top Jewel Drawer, Veneered with Zebra Wood and Rosewood; No Projecting Draw-pulls, as Drawers Set Forward Over One Another and Finger Grooves are Under Projections. Hand-hooked Rugs. Stool Upholstered in Unborn Calf Skin; Curtains, Embroidered Ecru Net; Bedspread, Embroidered Ecru Silk, Quilted Effect.

BOOK DEPARTMENT

ROADSIDE DEVELOPMENT

A REVIEW BY
WALTER KNIGHT COLE

THE American people are spending an ever-increasing portion of their leisure time in the open, along the highways and byways which form a network over the entire expanse of the country. Automobiles are constantly carrying countless millions to and fro, and the natural and artificial features that form the surroundings of these roads are bound to have at least a subconscious effect on the spirits and minds of those who spend such a large portion of their time traveling the roads or resting along the roadsides. It might be said that the great system of roads in America forms an outdoor home for the people, and that as much attention should be given to beautifying and maintaining the surroundings of the outdoor part of the home as is given to the decorating of actual dwellings. It is quite certain that the automobile and good roads have had a very definite effect on domestic architecture. It is no longer so important to provide broad porches and other places where the householder may spend all his leisure time, since it is more than likely that he will have very little time to devote to staying at home, especially if he has available roads whose surroundings are not only pleasing to the eye but also furnish all sorts of utilities for his convenience and pleasure.

A Grade Separation, Tuckahoe Road, Bronx River Parkway, New York

Of course the part of the road that is of paramount importance to the traveler is the roadway itself. It is more important to have a broad, smooth driveway than it is to have elaborate landscaping surrounding a rough and inferior pavement. However, if it is possible to have both a fine roadway and pleasant, tasteful surroundings, the effect on the mind of the stranger is favorable, and he is filled with respect and liking for the inhabitants of the country through which he is passing. Often it is only necessary to take advantage of the natural beauty of the terrain along the right-of-way in which the new roadway has been built. By cutting the grass, cleaning up underbrush and grading off the shoulders of the road as well as of any cuts or fills made during its construction, the general effect of prosperity and good will may be increased to a surprising degree. Then, too, there are instances where the natural features need to be augmented by the planting of nursery trees or shrubbery. This may be done according to either a formal or an informal plan, depending upon the nature of the countryside or suburban district through which the road is passing. Public utility lines which run along roads are seldom assets to the beauty of the surroundings, but their objectionable features may be reduced to a minimum by careful planning and designing on the part of representatives of the companies and the men responsible for layout of roads, and this should be done.

Other features which have a lasting effect on the beauty of the surroundings include, of course, the design and construction of the engineering structures built in connection with road construction, such as bridges and culverts. It is in this department of road building that architects are most likely to be interested, since they are often called in to consult and collaborate with engineers in the designing of such structures. This type of design offers an opportunity for the beautifying of the road system. Beautiful bridges have always thrilled the human mind and will probably continue to do so as long as they continue to be beautiful. Even smaller culverts and their parapets should be carefully designed from an æsthetic point of view if the utmost in beauty of the roadside is to be attained.

Another type of roadside accessory in which architects have a professional interest is the convenience stations that are being placed along the highways at intervals to serve the traveling public. This type of building has been receiving considerable attention of late, and some very interesting and charming bits of architecture have been designed to serve these purposes. Service stations for the sale of supplies to automobilists of course are more often than not hideous blots on the landscape, being designed to attract attention to themselves rather than to beautify the scene. Some of the large gasolene dispensing companies have evidently made some efforts in the direction of building more pleasing stations, but the commercial urge has in most cases been too strong, and beauty has suffered accordingly. In some cases where comprehensively planned road developments, have

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been laid out, the governing authorities or commissions have kept control of the construction of such gas stations, with the result that they are pleasing adjuncts to the landscape. A good example of this is the Hutchinson River Parkway of the Westchester County (N. Y.) Parkway system, where only one or two stations have been built in the entire length of the road. These stations have been carefully planned to fit in well with their surroundings, and in this their architect has been quite successful, but it is the exception proving the rule.

One of the leading road development systems in America,—if not the leading system,—is that Wayne County, Mich., which is famous the country over for its splendid roads running through right-of-way carefully kept and improved. One of the men who have helped to bring about this excellent system of roads has made a careful investigation of the subject of roadside development and has published the results in book form. This is J. M. Bennett, Superintendent of Parks and Forestry, Board of County Road Commissioners, Wayne County, Mich., and the work, entitled "Roadside Development," is issued as one of the "Land Economics Series." The author's long experience in the planning and developing of roadside development in one of the outstanding programs carried out in America fits him well to compile a manual governing this sort of work. The data given in connection with the various descriptions and discussions have been taken from the records in connection with the construction of these Michigan roads.

A great deal will be found in these pages to interest the architectural reader, especially if he or she be interested in solving landscaping problems. The architect doing general work is often called upon to solve problems having to do with drives and roadways approaching houses or public building he is designing, as well as the leading in of lines of wires and pipes supplying public utilities to buildings. While the chapter here devoted to the designing and construction of the roadway, both as to itself and in connection with trees and poles along its side, was written for use in connection with the construction of public roads, there are many facts and suggestions that should prove helpful to those planning private roadways. Planting is a subject which is of course of prime interest to the landscape architect, and the general discussion of the subject contained in this work will no doubt present to landscape architects many new ideas and theories, based as it is on an experience having to do with the planting of thousands of shrubs and trees in a climate which is typical of a large portion of the more thickly settled region of the United States.

Nor has the author confined himself to trees suitable to his native Michigan but has included in his investigations and descriptions trees suitable for roadside planting in all parts of the country. The actual planting methods employed by an organization having to do with planting on such a vast scale will be found of great practical interest to all interested in beautifying their natural surroundings. The chapters on planting materials, planting and seeding and sodding, will be of course interesting to architects only in a general way, as are also the chapters on the maintenance and preservation of trees. The chapter on comfort stations, however, treats a subject which may well become of interest to at least some members of the profession. In fact, the construction of public comfort stations along public highways has become

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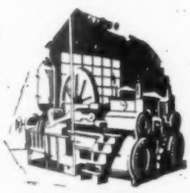

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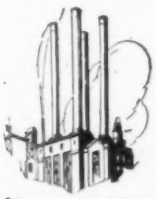

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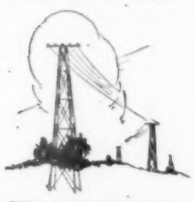

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For his chapter on Parkways, Mr. Bennett has come east and draws much of his reference matter from the reports of the chief engineer of the Westchester County Park Commission, whose system of parkways is world famous. Many photographs used for illustrating this chapter and others were taken along the Westchester County roads, and these together with a large number from Wayne County, Mich., and some from various other parts of the county lend greatly to the interest of the book; layouts of trees and roads and other technical matters are illustrated by maps and diagrams, adding to the lucidity of the explanations. The designing of lamp posts is another subject discussed and illustrated that will have more than usual interest for the architect, this compromise between utility and beauty being something that one may be called upon to design in connection with other work. They offer a fine opportunity for original treatment, and as a general thing there is an opportunity for improvement in the appearance of the light standards that line our streets and roads. There is a strong tendency toward extending systems of road lighting across country along all the more thickly traveled roads, and it is to be hoped that those in charge of the construction will employ designers competent to produce pleasing standards that will fit well into the surrounding scenes.

Although this work was obviously written to serve those who are concerned with public road construction and beautification, the architectural reader will be able to glean a great deal of interesting and practical information from its pages, to say nothing of the wealth of material as interesting to him as to a general reader. The description of the progress that has been made throughout the nation will give an idea to what an extent road building developments have been undertaken and carried on. In the appendices will be found reprints of the New York Parkway Law and the laws of New Jersey relating to roadside development and shade trees.

ROADSIDE DEVELOPMENT. By J. M. Bennett. 265 pp., 5½ x 7¾ ins. Price $5. The Macmillan Company, 60 Fifth Avenue, New York.

PERSPECTIVE DRAWING. By Joseph Brahdy. 104 pp. 6 x 9 inches. Price $2. D. Van Nostrand Company, Inc., 8 Warren Street, New York.

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VOLUME LI — NOVEMBER 1929

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Cover Design: Metal Window Grille, Hartford County Building, Hartford.
From a Photograph by Sigurd Fischer

The Editor's Forum — Page 37

The Alhambra, Granada — *Frontispiece*
From a Water Color by Carroll Bill

PLATE ILLUSTRATIONS	Architect	Plate
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THE ARCHITECTURAL FORUM is published monthly by National Building Publications, Division of National Trade Journals, Inc., 521 Fifth Avenue, New York.

H. J. Redfield, Chairman of the Board and Treasurer; Howard Myers, President and General Manager; John Thomas Wilson, Vice President; James A. Rice, Vice President; C. Stanley Taylor, Vice President; Henry J. Brown, Jr., Secretary.

Yearly Subscription, Payable in Advance, U. S. A., Insular Possessions and Cuba, $7.00. Canada, $8.00. Foreign Countries in the Postal Union, $9.00. Single Copies: Quarterly Reference Numbers, $3.00; Regular Issues, $1.00. All Copies Mailed Flat. Trade Supplied byAmerican News Company and its Branches.

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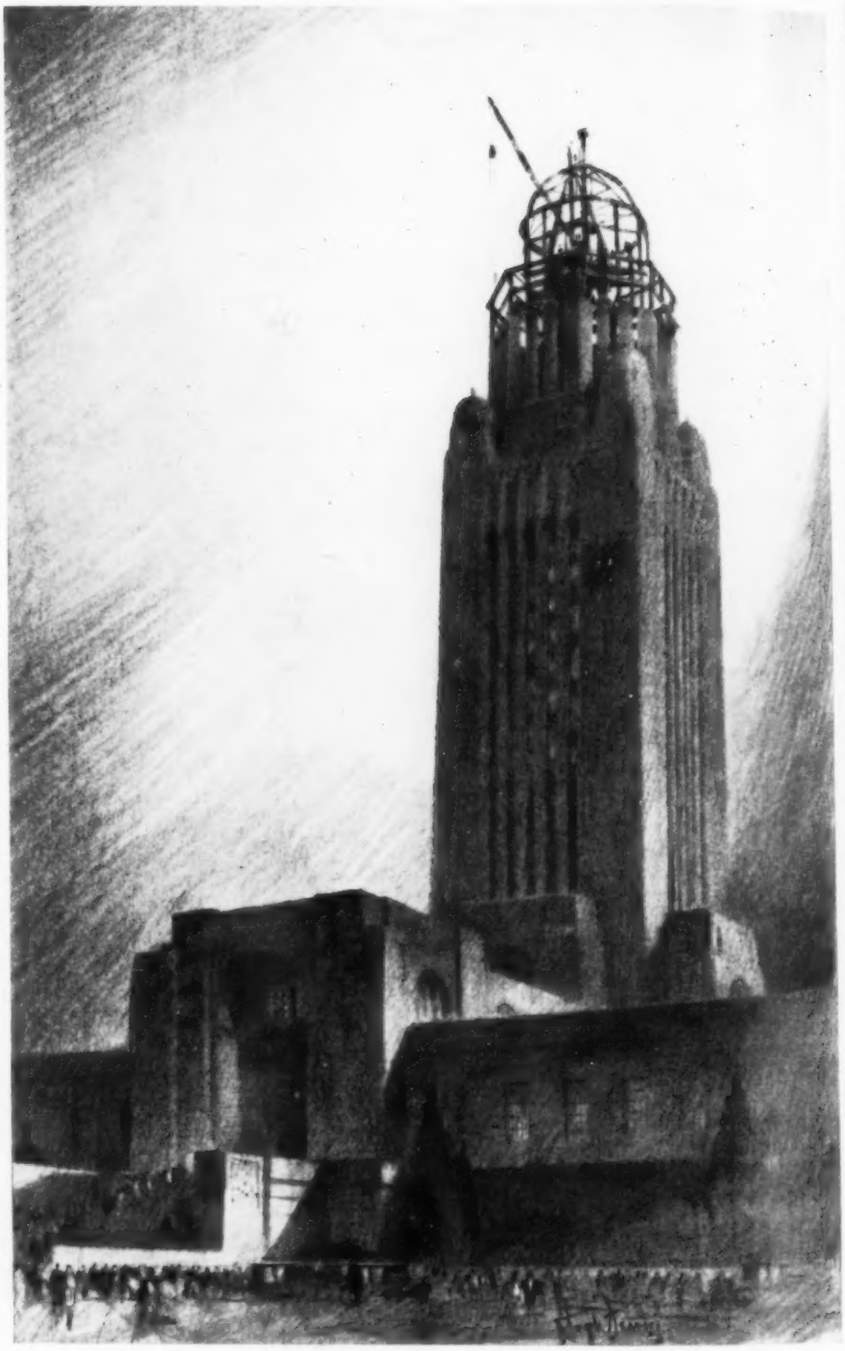

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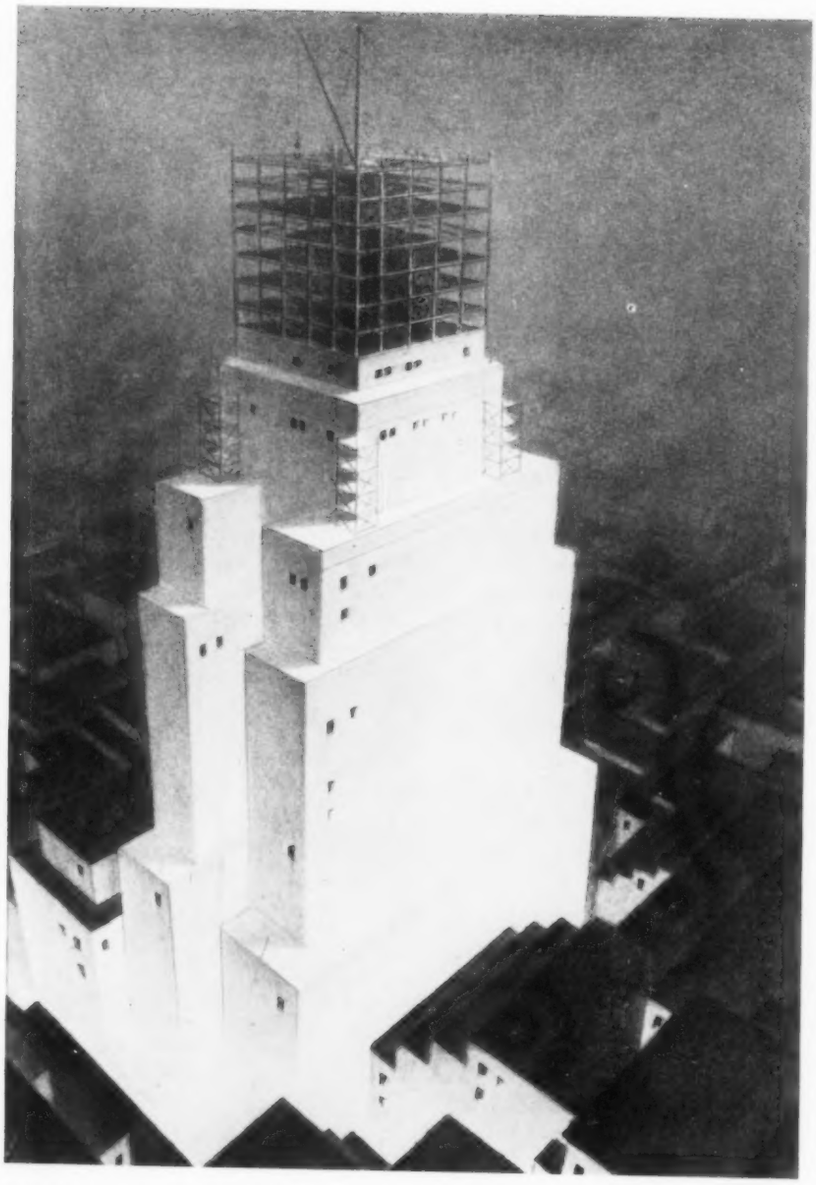


BUILDING THE TOWER

From a Drawing by Tabu

The Architectural Forum

UNIV OF MICH

THE
ARCHITECTURAL
FORUM

VOLUME LI NUMBER FIVE

NOVEMBER 1929

ACOUSTICS OF PICTURE THEATERS

BY

CLIFFORD M. SWAN

THE telephone rings. "Long distance calling. Smithtown, Palatial Theatre. New installation of talking picture a failure owing to bad acoustics. Advice necessary at once or house must close." Such is the typical S.O.S. call for help. It has been so frequent since the inception of the so-called "sound films" that it is of interest to analyze the causes and see how they can be corrected.

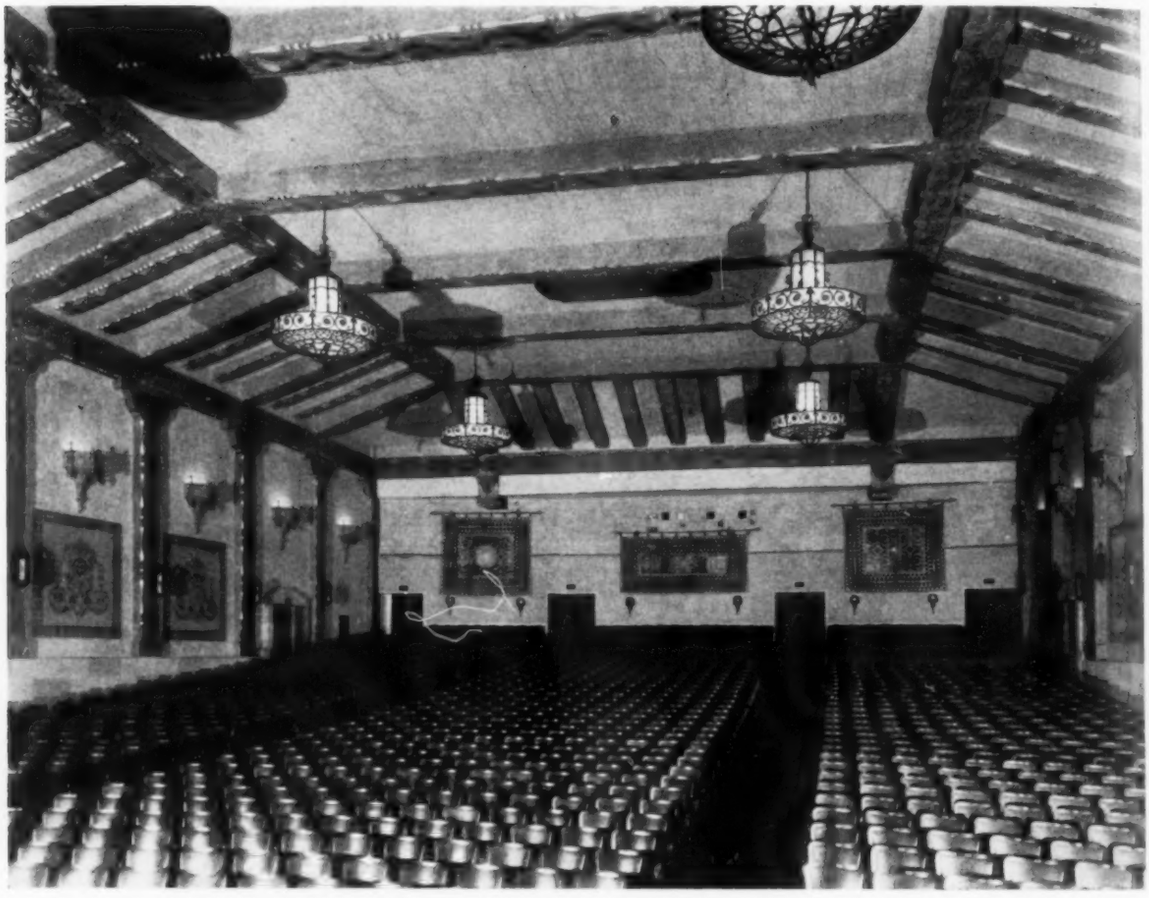
Of course, the general features of the case are not new, since acoustical qualities have long been studied not only in theaters but in all types of auditoriums. The problem becomes insistent under present conditions, however, for two major reasons. One is the fact that most of the theaters now used for talking pictures were originally designed only for the "silent drama," so that the question of hearing was not a matter to consider. The other reason is the great increase in the volume of sound developed as compared with the intensity normally given by the unaided voice or musical instruments, thus calling for a lower reverberation period than in the ordinary auditorium.

Another important consideration, added to the factors of design and reverberation, is the proper placing and operation of the sound-projectors, more often overlooked than one would think possible. Finally there is the disturbing effect of noise of ventilating fans, projection machines and other sources inside and outside of the theater.

Reverberation. First of all, let us consider reverberation, since this phenomenon has become fairly familiar in its general aspects in recent years through much discussion and advertising. Reverberation is the duration or persistence of sound in a room after the source has ceased to give out energy. It is caused by the multiple reflection of the sound waves from one surface to another before their energy is absorbed. Obviously, the more absorbent the surfaces the less time the sound will take to die away. On the other hand, if the surfaces are good sound reflectors, the period of duration may amount to a number of seconds. The effect of the latter condition is to cause a confused jumble of sound whenever words or musical tones are produced in rapid succession. This is increased with the size of the room and the loudness of the originating sounds and is much worse for speech than for music.

Omitting for the moment consideration of metropolitan picture houses which have a considerable amount of absorption due to carpets, hangings and upholstered seats, let us look at the condition of the large majority of motion picture theaters, especially in suburban or country districts. Many of them are mere barren halls with plaster walls and ceiling, wood or concrete floors, and bare wood seats. The only absorption is supplied by the clothing of the audience, and this is often confined to the floor, since there is frequently no gallery, or at best only a shallow balcony.

The absence of furnishings or other absorptive materials is not noticed as long as these houses are used only for silent pictures, but as soon as sound pictures are introduced, trouble immediately looms large. Reverberation, created not only by the very existence of sound but accentuated by the high level of intensity, makes conditions almost intolerable. Intelligibility becomes so imperfect as a result of the overlapping and blurring that the public refuses to be attracted, even by the novelty of the talking feature. Under such circumstances, obviously demanding prompt action, relief has naturally been sought in the placing of absorbent materials somewhere in the auditorium. This is often done in random fashion without due regard either to the amount of material necessary to produce the best degree of reverberation or to its location as influenced by the shape of the room. For these reasons, the results of such blind procedure are sometimes disappointing. Likewise, in the more richly furnished city theaters, where conditions are apparently satisfac-



Typical Theater Without Balcony, Showing Necessary Rear Wall Treatment to Prevent Echo, as Well as Ceiling Treatment to Reduce Reverberation

tory for ordinary speech or music, the amount and disposition of the absorption are not always the best for the new type of sound origin.

As the result of some 30 years of experience in the adjustment of auditorium acoustics, the optimum time of reverberation has been fairly definitely established for varying sizes of rooms as used for speaking or for instrumental or vocal music. In the normal auditorium there must always be some reverberation to preserve tone quality and sufficient loudness to hear comfortably. On the other hand, excessive blurring must be eliminated. The optimum period represents the compromise of the average ear between these requirements. If we take an auditorium which has thus been adjusted for normal source intensities and then substitute a source many times louder, as in the case of the amplified reproduction in talking pictures, the time of reverberation is materially increased. This means that additional absorption must be introduced to restore the reverberation period to the optimum value. Exact figures are difficult to give because the sound reproduction is not always presented at the same level of intensity. On the average, however, the talking picture house requires about from 20 to 25 per cent more absorption than if used for unamplified speech.

The actual area to be covered by any given absorptive material will be obtained from the number of absorption units as just outlined and the absorption coefficient of the material chosen. Sound-absorbing materials may vary widely in their efficiency over the range of audible pitch, and different materials have varying efficiencies. For the most perfect results, therefore, care should be exercised in the choice of material to be certain it will meet the requirements of the case, not only a single pitch, but over the entire range.

Location of Absorbing Materials. Of equal importance with the amount and kind of material chosen is its location. Indeed, its apparent absorption and its consequent effect upon the reverberation are dependent to some extent on its position. Furthermore, reflection from some surfaces is more harmful than from others, on account of the production of echoes and dead spots. Such surfaces should receive preferred attention in their treatment. Their location will be largely a question of the design of the individual theater. It may be laid down as a general principle in almost all

Theater with Ceiling Curvature which Would Produce Echoes, Corrected by Using Absorbent Tile Vaulting

cases, however, that the rear wall of the auditorium should be made as absorptive as possible, and particularly if this wall is devoid of balconies or is curved in shape. In fact, curved surfaces are dangerous wherever located, whether on walls or ceiling. Even plane walls if parallel often produce flutter echoes. The rear wall, however, is of especial importance, since it faces the origin of sound and produces a direct reflection, and the more so if horns are used, since these have a marked directional effect particularly for high pitches, and therefore submit the rear wall to an intensified bombardment of sound. Very deep and low balconies may protect this wall from much of the direct sound, but the average small picture house seldom has this protection. In a large number of theaters the rear wall is segmental, following the curved line of the seat rows and with its center of curvature located somewhere between the front of the orchestra stalls and the rear wall of the stage. This is about the worst possible curve, as it is sure to produce focusing effects. It should be avoided in the design of all new houses. In those already built it must be covered with the most absorbent material possible. Perhaps the best solution as regards appearance and efficiency is to hang heavy interlined curtains in full folds over the offending surface. Other points to remember in designing new theaters are that flat ceilings are preferable, as are plane side walls slightly flaring outward from the stage,—and that sharply curved surfaces of short radius, such as coves and corner curves, are permissible.

Sound Sources. Sound projectors are of two general types, — the disc and the horn. Disc speakers give a better diffusion of sound throughout the theater and consequently a better distribution of intensity. Horns are very commonly used, however, and on account of the directional effect already noted, make particularly imperative a careful study of the shape of the auditorium. Some such sources produce a beam of short waves analogous to a slightly divergent beam from a searchlight. The number and kinds of curious and unexpected echoes which can result from such a wave concentration when combined with a variety of curved walls and a vaulted or domed ceiling are truly remarkable. Since most of the sound from such projectors passes directly ahead, the auditorium should be limited in width—another

point to be borne in mind by the architect in new designs. If the theater is wide, sound will reach the front corners and extreme sides largely by reflection alone, and hearing will be difficult.

Another precaution which must be taken, especially with such directional sources, is the arrangement and relative positions of the several horns employed. Many cases arise where the acoustical condition of the auditorium is as nearly perfect as possible, and yet dissatisfaction is found in the hearing, simply because of improper placing of the loud speakers. Ideally, the sound should all proceed from as nearly one point as possible. Wide separation of the projectors,—the more so if they are strongly directional,—almost inevitably causes local regions of confusion in the auditorium due to imperfect registration of the various wave trains as a result of difference in length of path. A solution has been found in concentrating the loud speakers directly behind a picture screen, permitting the passage of sound. The only drawback to this is the partial selective absorption by the screen.

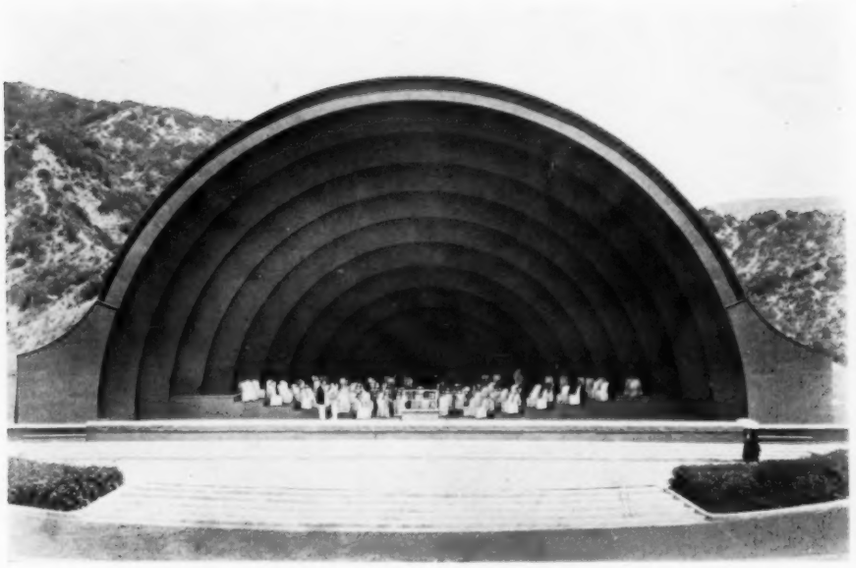
Extraneous Noises. There are still further points to be considered in the production of an auditorium thoroughly comfortable for hearing. These relate to the disturbing effect imposed on the ear by noise originating either inside or outside of the theater. Like dirt, which is said to be matter out of place, so noise is sound out of place. Conversation, which has its legitimate uses under suitable conditions, becomes noise when it interferes with a program of entertainment. The hum of a dynamo may be a musical tone, but it is noise when it intrudes upon desired quiet. The sound of a dance orchestra is often the worst possible noise to one trying to sleep in a nearby apartment. Any sound which interferes with the business at hand must be classed as noise.

In the case of the picture theater, noises may arise from a number of sources,—conversation or movements in lobbies and corridors, the sound of traffic on the street, the whir of ventilating fans, the hum of the motion picture machine, restlessness and coughing in the audience, and sometimes the reverberation of the stage chamber. Of course, the first precaution is to prevent as far as possible the production of such noises. Lobbies should be carpeted or have an absorptive material on the ceiling; aisles and spaces between the rows of seats should be covered with resilient deadening material; ventilating fans, motors and projection machines should be as silent as practicable.

Such noises as remain despite these efforts must be excluded from the auditorium. Doors leading into lobbies should be kept closed. The noise of persons walking and talking in such antechambers, together with the sound of street traffic, is a source of serious annoyance to those of the audience in the rear rows. Effective door barriers are an inestimable comfort. Fans and motors should be located as far as possible from the auditorium, preferably in a basement, but in any case on a rigid, heavy main foundation and mounted on cork. Ducts should be broken by a canvas sleeve near the fan. If noise passes through the air column of the duct, a felt lining should be installed within the duct extending from the canvas sleeve up to and around the first bend in the pipe.

Projection rooms suffer not only from the direct noise from the machines but also from the increasing of this noise by the reverberant interior of the space. Such rooms should always have a fireproof, sound-absorbent material applied to the inside surfaces of their walls and ceilings. In theaters where the stage is large and bare, there may be sufficient reverberation to magnify sound from the loud speakers or other sources. If this is great enough to be annoying, absorbent materials can be introduced to correct the difficulty. In many cases the sound projectors are housed in a horn tower or some similar structure. Of necessity, this must have a certain area of openings to permit of re-circulation. In order to prevent the escape of sound from these openings, the structure should be lined with absorptive material.

Of course, on account of the great loudness of the sound from the horns, the importance of many of the noises here enumerated may have been overemphasized and not appear to be as disturbing as in an ordinary auditorium. Still, they are excitants of the auditory nerves and shoud be eliminated.



THE ORCHESTRA SHELL OF THE HOLLYWOOD BOWL

BY
ARTHUR T. NORTH

AUDITION and vision must be correctly related to an audience to produce a complete presentation thereto. Both of these aims can be effected in enclosed spaces by well established methods, but securing good audition in open spaces has been a difficult problem to solve. The rapidly increasing number of outdoor auditoriums makes the securing of satisfactory audition a matter of prime importance. This problem has been solved successfully in the Hollywood Bowl by the use of an orchestra shell of unusual design.

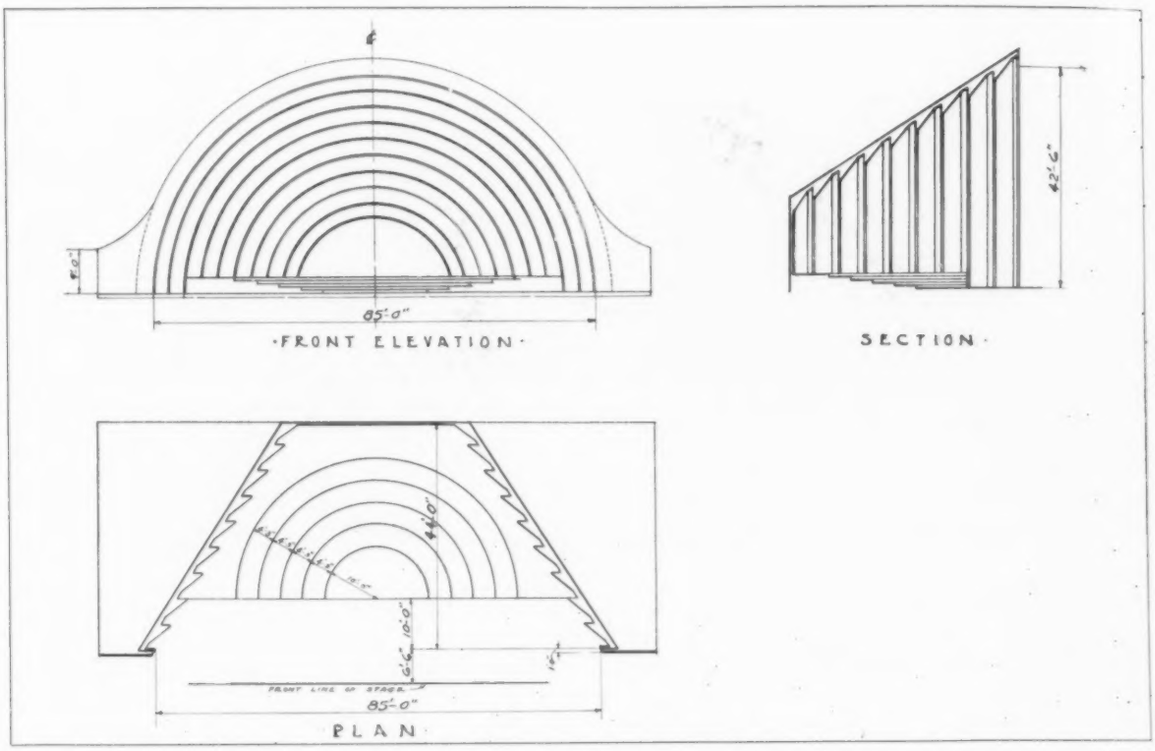
The Hollywood Bowl consists of a seated area built on a sloping hillside extending 550 feet from the stage which is placed at the lowest level. Opposite the seated area there is a corresponding hillside. The stage is 45 x 105 feet in size and is used several times a year for the presentation of elaborate pageants. At other times it is used for orchestral concerts, so the necessity for perfect audition is readily apparent.

The present orchestra acoustical shell is a steel frame structure erected on a movable steel frame floor system which is fitted with forty-seven 6-inch in diameter, double-flange, roller-bearing cast iron wheels which travel on five lines of 30-pound rails. With clips and cap screws the rails are attached to inserts built into the stage floor. When the orchestra shell is not in use, it is removed and the rails are taken up, leaving a flush stage floor. The framework of the shell is made of nine semicircular lattice steel trusses supported on the movable floor framework. The trusses are concentric, spaced about 4 feet apart and having decreasing spans. The weight of the shell and platform, without the walls and roof of the dressing and instrument rooms, is approximately 55 tons. The weight of the structural steel is 36 tons. The entire structural steel work was welded.

The flooring of the shell is made of wood, and the steel frame is covered inside and outside with flat, dense asbestos board sheets. A curtain is used to close the shell against the weather when not in use. It is made in two pieces, fastened along its lower edge, and it opens and closes like a folding fan. Wheels fastened to the curtain operate in a track attached to the outer perimeter of the front of the shell. It is operated by an endless cable and a hand winch located in the left wing. During performances the curtain is stored in a box, the cover of which forms the front portion of the stage.

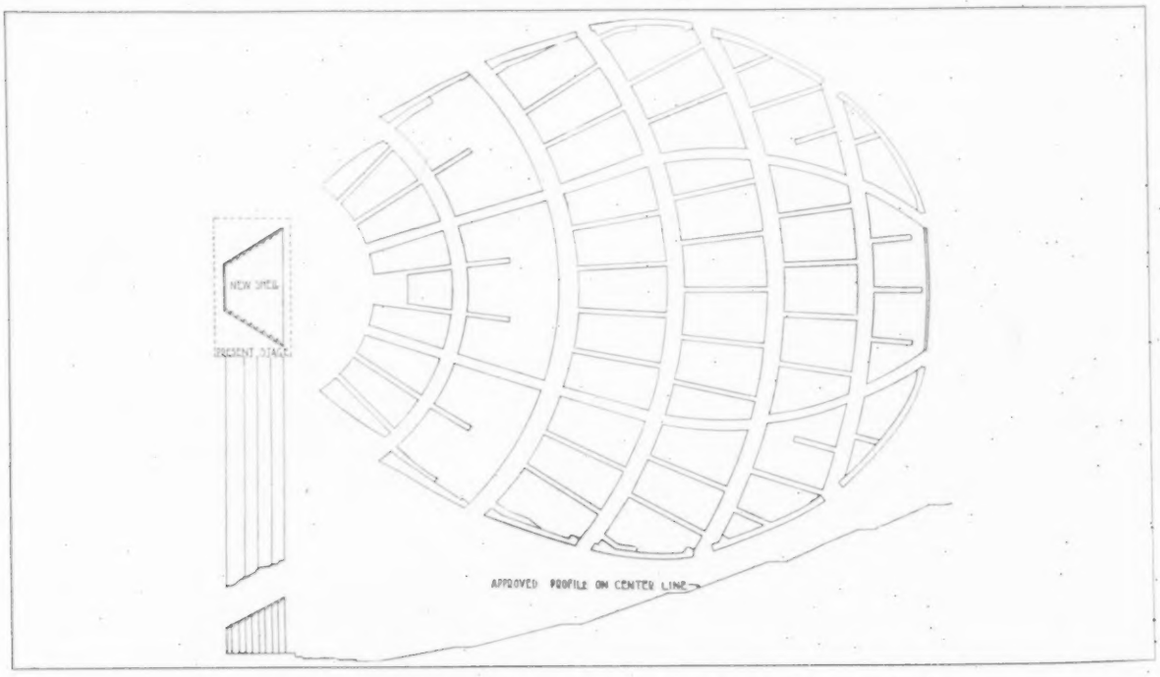
The maximum distance at which ordinary unamplified speech can be heard effectively in the open is generally accepted to be from 100 to 150 feet from the sound source. Sound will carry to much greater distances, however, when good sound-reflecting surfaces are placed behind and at the sides of the speaker. This principle of sound-reinforcing by reflection is applicable to all kinds of music, including that of an orchestra.

The most simple type of orchestra shell consists of a highly reflective vertical wall placed directly behind the orchestra. Such a wall or sounding-

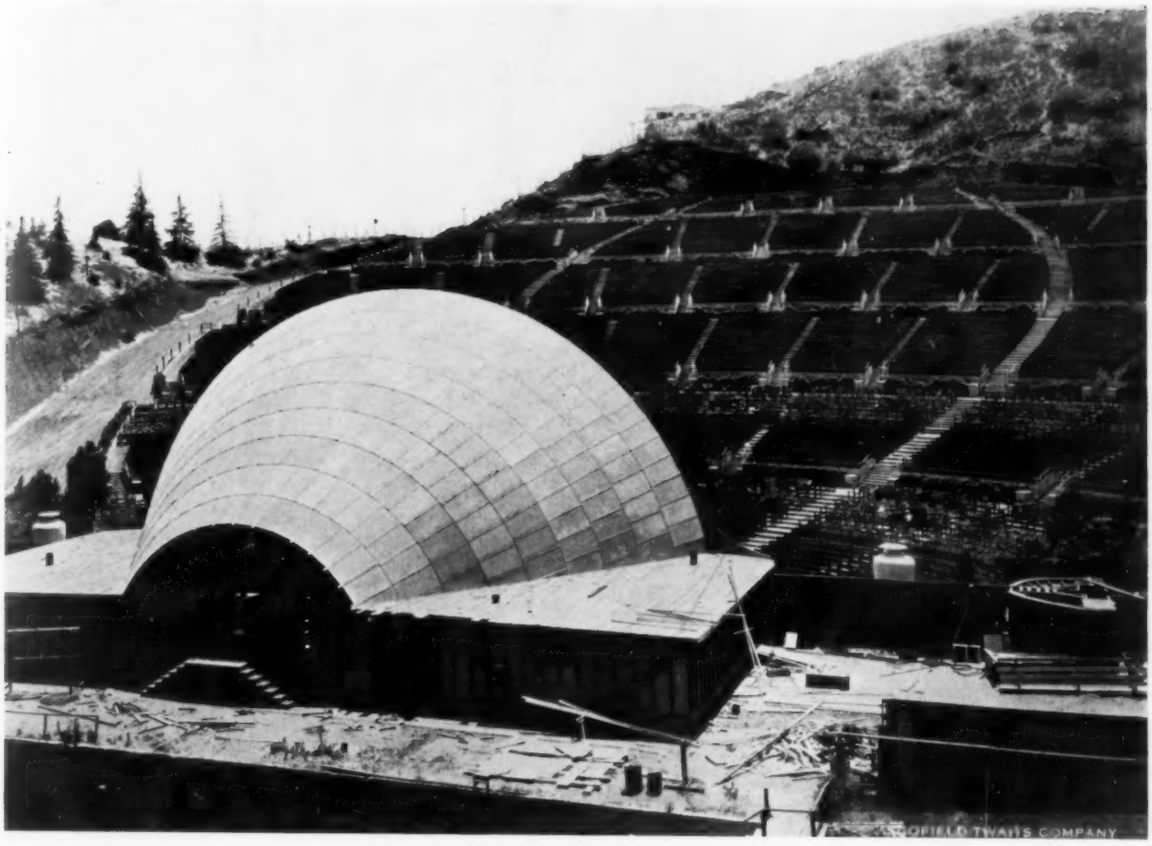


Plan and Sections of the Orchestra Shell

board would approximately double the intensity of the sound projected to the audience. The effectiveness of such a simple type of orchestra shell is greatly enhanced by an overhead reflecting surface. When this overhead sound-reflecting surface is placed at an angle of approximately 45 degrees above the horizontal, it would be suitable for projecting sound to an audience seated on a level area and at the same elevation as the orchestra. A seated area which is inclined and rises from the



Plan and Profile of the Hollywood Bowl, Showing the Orchestra Shell



View of the Orchestra Shell and the Bowl

orchestra level necessitates having an angle of the overhead reflecting surface greater than 45 degrees.

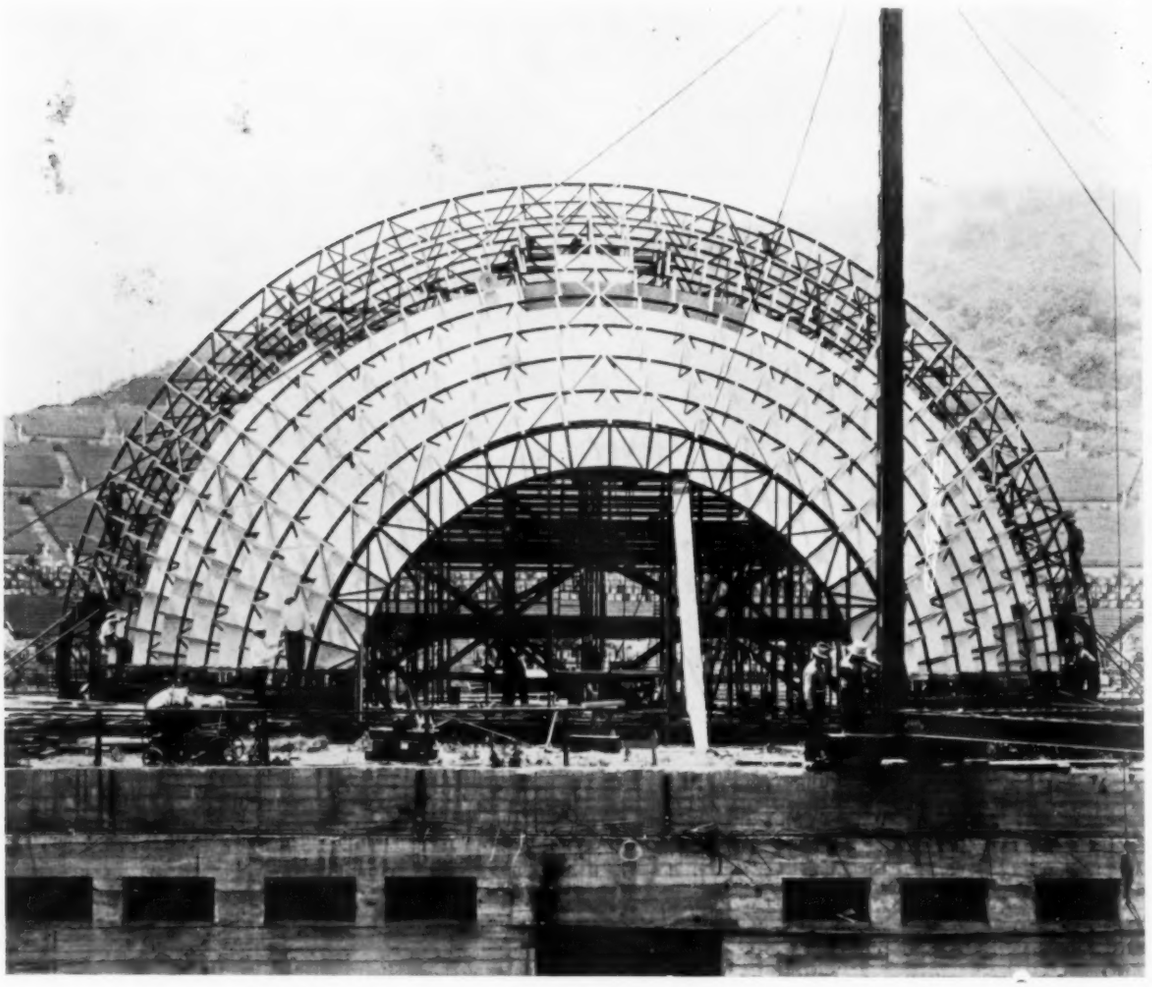
The seated area of the Hollywood Bowl is inclined at an angle of about 12 degrees above the horizontal. The last tier of seats, 550 feet from the stage, would be about 115 feet above its level. This condition requires the overhead reflecting surface to be pitched at an angle of about 51 degrees above the horizontal. With the overhead reflecting surface pitched at this angle the sound which rises vertically from the orchestra will be projected parallel to the slope of the seated area.

Vertical and inclined reflecting surfaces were placed behind and above the orchestra in one of the first shells constructed at the Hollywood Bowl. A shell constructed later was a combination of vertical walls behind and at the sides of the orchestra with plain parabolic surfaces above the orchestra. Although this shell gave a strong reinforcement to the sound, it was unsatisfactory because it produced an overemphasis of tones of those instruments located near the focal lines of the three overhead parabolic surfaces.

The form of the final design of the permanent orchestra shell is one-half of a truncated right circular cone having an outside radius at the front of 45 feet, 6 inches and of 18 feet at the back. The pitch or slope of the cone is 51 degrees. The structure is made up of a number of concentric reflecting surfaces. These concentric bands or surfaces prevent the focusing of the sounds of the various instruments. The sounds originating at any point on the orchestra platform in general are directed toward the audience seated in the Bowl with a slight advantage to those seated at great distances from the shell. That portion of the audience which is seated near the shell receives the direct sound waves from the instrument origins without reflection and of adequate intensity.

The primary function of the orchestra shell, which is to project the sound with adequate intensity over the vast seated area, is attained satisfactorily. The shell is free from such customary defects as echoes and sound *foci* and effects a diffused reflection of sound to all parts of the Bowl. The faintest tones of the violin are clearly audible in the most remote seats. The acoustics of the Bowl are enthusiastically praised by musical critics.

That portion of the movable platform outside of and at the rear of the shell is roofed over at the height of 8 feet and enclosed to provide rooms for the directors, soloists, musicians and for instruments. The permanent means for moving the platform and shell have not yet been provided. It



Welded Steel Frame of the Orchestra Shell, Partially Covered

will be moved probably by means of a small hoisting drum and motor located at the far end of the tracks and connected to the movable platform by an endless cable, or it will be moved by a direct attached motor truck or tractor. It is not probable that motive power will be installed on the platform itself.

The designing of the semi-circular steel trusses involved some very complicated calculations. The stress analysis of the arch ribs was made by applying the theory of the deflection of curved beams and the aëro-dynamical theory of wind pressure on a cylinder. Two analyses were made, one for wind and one for dead load stresses. Equations were written and solved for thrust, moment and radial shear and the corresponding curves drawn. It was thus possible to compute easily the maximum flange section required and the size of the web members at various points without the use of the customary stress diagrams.

A rough acoustical test was made when the shell was completed. Listeners were placed at 26 different locations in the Bowl, and one No. 10 bird shot was dropped varying distances onto a kettledrum located near the center of the shell. When dropped a measured distance of 8 inches, the sound was heard over the entire Bowl area. The drop was then decreased and the varying degrees of audibility in the different parts of the Bowl were plotted. It was found that the sound generated by dropping the shot ¼ inch onto the head of the kettledrum could be heard distinctly over three quarters of the Bowl area. Numbers were then whispered from the shell and called back by persons in all parts of the seated area.

In the designing and construction of the orchestra shell, the Hollywood Bowl Association was represented by Professor R. R. Martel, California Institute of Technology, as consulting engineer. The designing and supervising personnel included Messrs. Elliott, Bowen and Walz, consulting engineers; Frank Lloyd Wright, architect, and Dr. Vern O. Knudsen, physicist and consultant on acoustics.

CHILLED AIR DISTRIBUTION IN THEATERS

BY
WILLIAM GOODMAN
MECHANICAL ENGINEER

VENTILATING theaters today has become not only a problem in maintaining the proper temperature and humidity, but also a problem in the proper distribution of the air throughout the house. Warm air drafts on the feet and the back of the neck are unnoticed, but let the air become slightly chilled, and these same drafts become a serious annoyance.

Formerly air was almost universally supplied through "mushrooms" set in the floor. Few mushrooms were provided, and as a result, air passed through these mushrooms at a high velocity. This did not matter with warm air, but when the same system of air introduction was tried with refrigerating plants, another story was told. Most of us have vivid memories of having sat at one time or another over a small gale of vigorously blowing cold air. Today large numbers of mushrooms are used. It is usual to provide a mushroom for every 65 cubic feet of air supplied per minute to the auditorium. With this volume, the air leaving the usual type of mushroom has a velocity of roughly 100 feet per minute. This velocity will not cause serious drafts. However, an abundant supply of mushrooms will not insure a low air velocity unless the air velocity in the tunnels or plenum chamber below is very low. Air shooting down a tunnel at a high velocity means high air velocities through the mushrooms, inasmuch as velocity changes cannot be abruptly made,—a fact which many engineers seem to forget,—and as a result, even systems with sufficient numbers of mushrooms will produce feet drafts. When using a floor supply system, exhaust grilles are provided at various points in the ceiling and balcony soffits. All the exhaust should not be concentrated in one large grille in the center dome. The exhaust system is not only a means of removing air but also of securing a proper distribution of the fresh air by drawing it across portions of the house where it is needed.

As theaters are being designed today, the hottest, stuffiest portions of the auditorium will be found at the rear of the house, in three places: 1. Under the mezzanine boxes. 2. Under the balcony. 3. At the highest points of the balcony. The ceiling heights at these points seldom exceed 12 feet and are more often 10 feet. A vigorous exhaust should be provided at these points, and the exhaust grilles should be placed at intervals across the entire width of the house. Very often it is difficult to work grilles into the design of the balcony soffit or the main ceiling. In that case, it is possible to connect ducts to the hand holes provided for changing the bulbs in the ever-present coves. This is a very convenient expedient and is often resorted to. Where the design consists of large round or octagonal plaques, these can usually be dropped 3 or 4 inches without being visible to the audience, and air can be drawn through the spaces thus provided. The fact that the hottest, stuffiest portions of the usual theater are at the rear of the house under the low ceilings of the balcony soffit and at the high point of the balcony will bear repetition. A liberal amount of air should be exhausted from the balcony soffit and from the rear of the main auditorium ceiling. Hot air clings to the high points of the house, and provision should be made for its removal there.

More recently theaters have begun to use the downward system of air supply. Air is supplied from the main ceiling, from the side walls high above the heads of those in the audience, and from the balcony soffit. The air is exhausted by mushrooms at the floor. This prevents drafts on the feet of those in the audience, but it also has its drawbacks, although as the situation stands now, the downward supply system is superior in the matter of preventing annoying drafts. In introducing air through the main ceiling and through the side walls high above the heads of the audience, little trouble is experienced from drafts inasmuch as the entering air becomes greatly diffused, due to the large number of exhaust mushrooms spaced over the floor.

The greatest difficulty with the downward system is in supplying air at the low points of the auditorium at the rear of the house, under the balcony, and at the high point of the balcony. As has been said before, the ceilings are seldom more than 12 feet above the floor at these points and more often are only 10 feet. To blow air down at these points would be impossible because of the chilly drafts produced. To blow air in horizontally from the rear walls is even worse, for the simple reason that the back of the neck is particularly sensitive to even the gentlest of cool breezes. The same breeze coming from the front and blowing directly into the face would be welcomed. Introducing air from the side walls is good, but owing to the width of modern houses, it is impossible to get a satisfactory distribution of air with a uniform temperature. Probably the best way to introduce air at these points is to blow it in horizontally or at an upward angle at a very low velocity through the

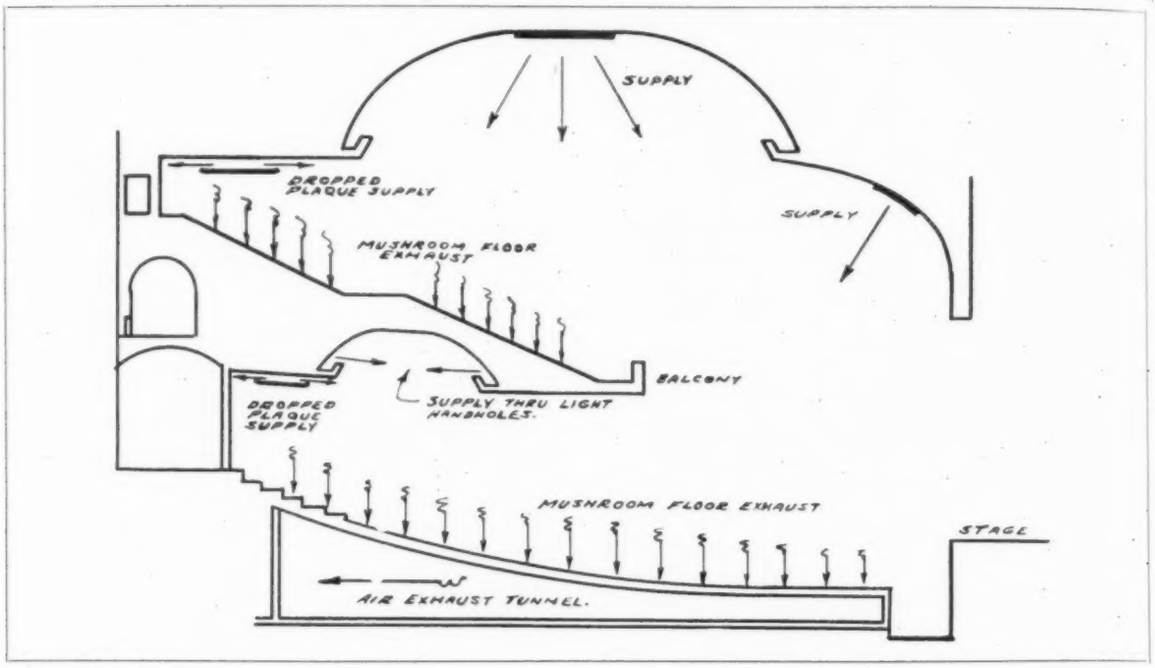
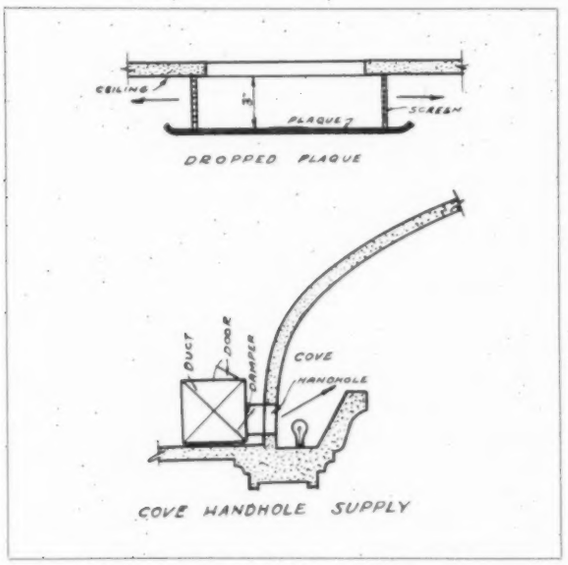


Diagram of the Downward Supply System

hand holes of the light coves. Another way of introducing air horizontally is to use the exhaust scheme previously mentioned,—that is, a ceiling design of ornamental plaques which can be dropped 3 or 4 inches below the remainder of the ceiling. In this way, the air is pretty well diffused before being sucked down by the floor mushrooms. In cases where this is impossible, the only thing to do is to use grilles or liberal areas in the ceiling or soffit and introduce the air at very low velocities. This method is always a gamble. It should be borne in mind that a grille of proper size connected to a duct carrying air at say 700 feet per minute, by means of a 12-inch long transition piece, will invariably deliver the air at the same velocity through a small portion of the grille, while the remaining portions are "dead." Transition or connecting pieces from duct to grille should be long in order to change the velocity gradually and, in addition, the transition piece should be divided into several sections by sheet metal partitions. These partitions should extend from the duct to the grille and will insure a proper distribution of air over the whole surface of the grille, instead of producing a high velocity spot and leaving the remainder of the grille dead. If proper connection is not made from duct to grille in order to reduce the velocity gradually from the duct velocity to the grille velocity, a small high velocity grille may as well be installed in the first place as far as results are concerned.



Two Methods of Providing Supply Outlets

When supplying air from the ceiling there are relatively few points of supply when compared to the number of supply points provided in a floor mushroom supply system. For this reason an exhaust is provided through a liberal number of mushrooms uniformly spaced over the entire main floor and balcony. The chief function of the exhaust system in a downward air supply system is to provide a proper distribution of the incoming air, by its sucking action.

The question of re-circulating the exhaust air is today highly controversial. There are consider-

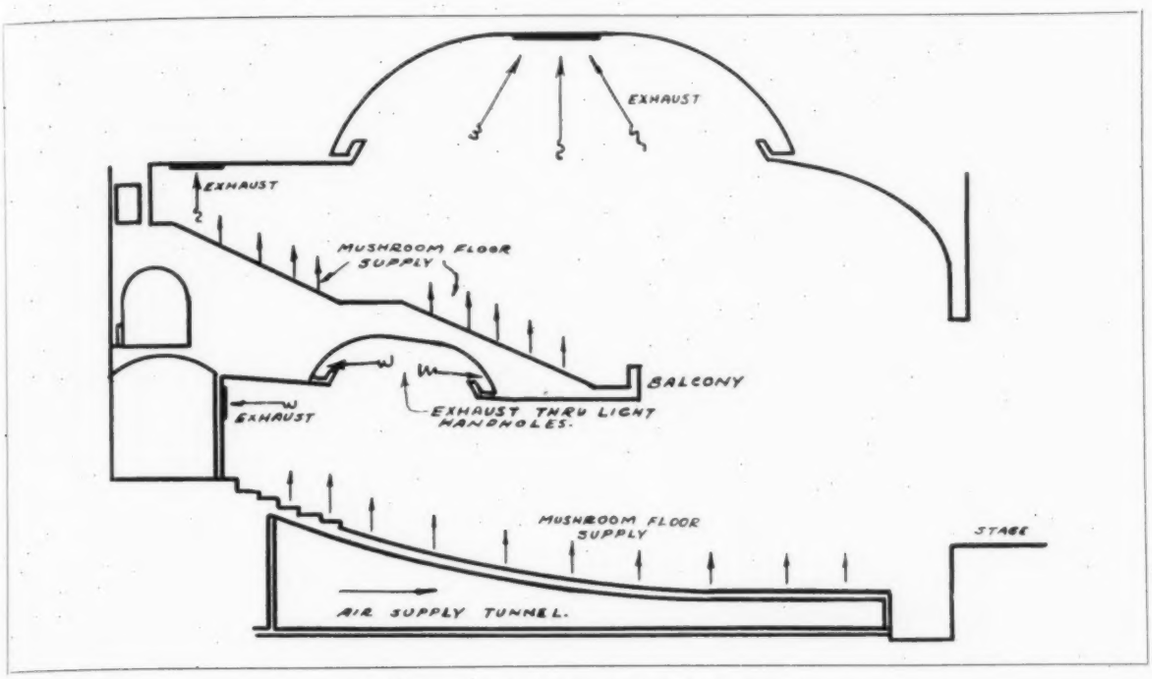
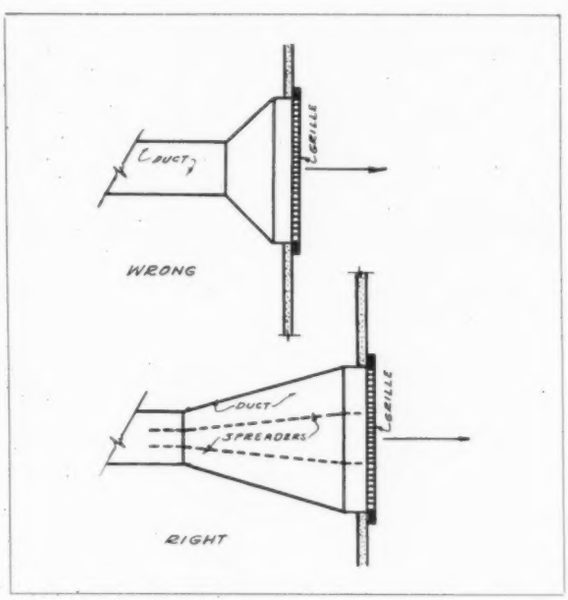


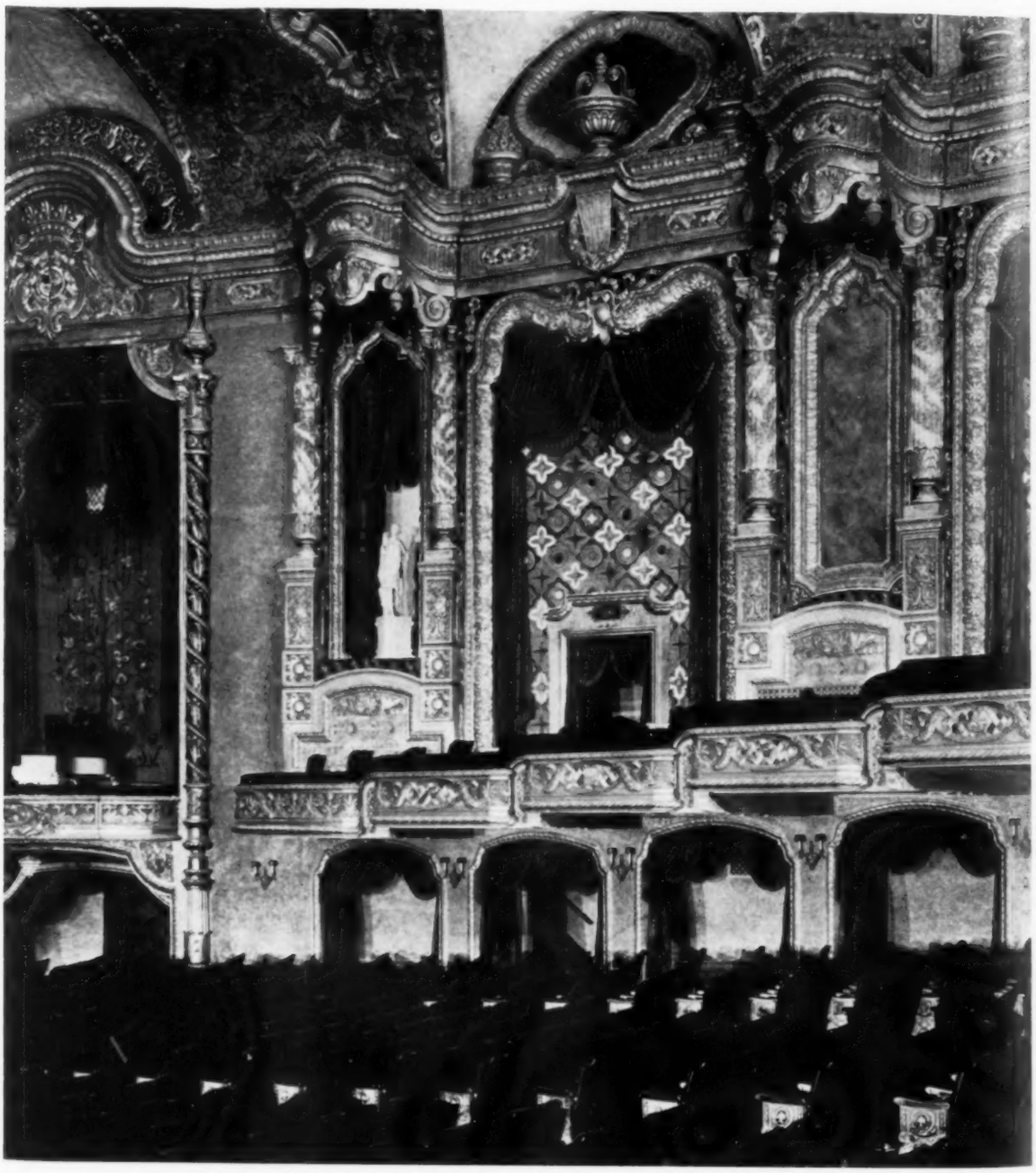
Diagram of the Upward Supply System

able operating savings to be made in both summer and winter by sending back into the auditorium all or part of the exhausted air, after passing it through the air washer. I have stood on the roof of a theater where the air which was being thrown out to the atmosphere was as cool, refreshing and sweet smelling as the fresh air which had just left the air washer, and it was certainly far superior in these qualities to the so-called fresh air which was being sucked into the air intake by the ventilating fan. This intake was located in an alley wall about 10 feet above the alley grade, and the air which was being drawn in was most emphatically lacking in the qualities just mentioned. The air washer and cooling coils perform seeming wonders and give this same air its refreshing qualities. The only doubtful point seems to be in connection with the bacterial content of the exhausted air, but it seems reasonable to suppose that the quantity of bacteria added to the alley air by a theater audience is negligible. The various city authorities as a rule forbid re-circulation, but a certain amount should be allowed. The ventilating system should be made flexible enough so that the exhaust air can be returned to the auditorium through the air washer or thrown to the outside and all fresh air taken in, or else so adjusted that any desired mixture of exhausted and fresh air can be sent into the air washer.

The question of the size of the refrigeration compressor to install is important because these machines are tremendously expensive, a 150-ton machine costing in the neighborhood of $25,000, installed and ready to operate. In Chicago, about ½ B.t.u. is roughly the amount of heat which should be removed from each cubic foot of fresh air, making one ton for every 400 cubic feet of air. No absolute figure can be given because so much depends on the theater itself, the heat gains, the amount of air re-circulated and many other items. For a Chicago theater of about 2,000 seats, a machine of about 150 tons ca-



Right and Wrong Duct Supply Equipment



The Piccadilly Theater, Chicago, has a Downward System of Chilled Air Distribution
C. W. & George L. Rapp, Architects

pacity would be satisfactory, allowing 25 c.f.m. fresh air per person. The extra tonnage would be used to cool lobby, lounge and foyer air.

All theoretical methods of calculating the tonnage which I have seen published so far give tonnages far in excess of the tonnages actually used to give satisfactory results. The calculation methods are theoretically correct, and the absurdly high results obtained are probably due to using heat gain coefficients and constants which are too high. It should also be borne in mind, that despite the "70 degree" advertisements so often seen outside of theaters and restaurants, no house is ever cooled down more than 10 degrees, or at the most 15 degrees below the outside temperature. If one were to step from a 92° outside temperature to a 70° inside temperature, the shock would be comparable to the feeling one experiences when a cold shower is suddenly turned on. Stepping from a 92° atmosphere into an 80° properly de-humidified atmosphere is surprisingly refreshing and stimulating, however.

ARTIFICIAL MARBLE AND SCAGLIOLA

BY

CLIFFORD WAYNE SPENCER

NO art has been subjected to greater abuse at the hands of the modern commercial competitive system than has the making of artificial marble, the result being that many have come to regard it as an altogether unsatisfactory material for building decoration. As a matter of fact, it is difficult to name any form of art work that has been carried to a point more nearly approaching perfection. When the process is carefully performed by a really skilled artist, as it must be to be at all satisfactory, the finished product reproduces the veining, coloring, texture and hardness of natural marble so exactly that the layman is completely deceived, and it is with some difficulty that even the experienced marble expert can detect the difference between real and imitation.

Advantages of its Use. It is not claimed that the imitation is ever superior, or even equal to the genuine product, but there are certain conditions under which the use of artificial marble is of distinct economic advantage and does not impair the appearance or durability of the work. In many instances its use enables the architect to attain the rich effect produced by marble interiors where the cost of genuine marble would have absolutely prohibited its use. Then, too, the use of artificial marble often affords the architect a greater freedom in the designing of interiors. He may desire to attain a definite effect by the use of a certain variety of marble only to find that that particular variety is not available, or that it can be had only after a considerable length of time. He is then faced with the necessity of changing his design to fit the marble supply, or he may have a marble made that will satisfy his desire exactly. This can and has been done, even to the point of "reproducing" a marble that has never existed.

The making and use of artificial marble seem to be subjects on which very little printed information is available. Most people, including some architects, go about surrounded on all sides by artificial marble without ever knowing that such a thing exists. When we enter a great theater or banking room, we may marvel at the size of the vast towering column shafts and perhaps even

A Small Black and Gold Column of Artificial Marble Being Polished in the Shop

Silk Fiber Being Spread to Give the Veining of Siena Marble

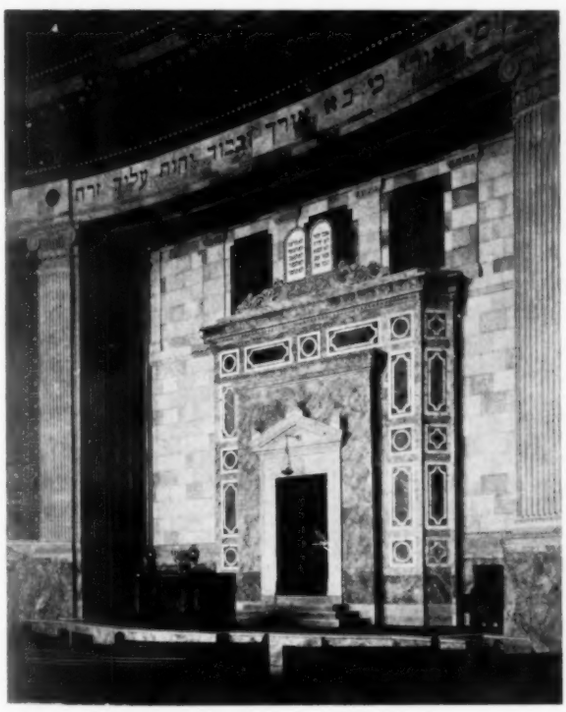
wonder how such great blocks of that particular marble could be found. As a matter of fact, in many instances it is quite probable that such blocks could not be found, since it is a recognized fact that in general, marbles of the more highly colored and elaborately veined types are seldom found in large blocks. Herein, then, lies another of the reasons for the use of artificial marble in preference to that of natural stone,—that is, it is possible to produce monolithic pieces in certain richly colored marbles that would not otherwise be possible even if price were not a factor. Another such reason is that in some cases certain particularly desirable marbles are no longer obtainable and that their reproduction in artificial marble is the only way in which they may be obtained; or it may be that marble work in such unobtainable varieties is to be added to or repaired. In such cases the skilled artificial marble maker can provide a much closer match than can be obtained in any other way. There are many instances of this sort of duplication in daily use where it is almost impossible to detect the point at which the natural marble leaves off and the artificial begins.

High Standards Necessary. Artificial marble work is such that it permits of no compromise between the good and the bad. Either it is an exact reproduction of natural marble or it falls immediately into the class of a cheap imitation of a good building material,—a thing which is such a curse to modern architecture. Therefore, it is necessary that the utmost care be exercised in the choice of the workman who is to do the work, that every feature be carefully specified, and that the specifications be carefully enforced. Intense competition among contractors has led to the introduction of so many bad practices in the process of manufacture that it is quite essential that the architect using this material be familiar with its uses and abuses to a rather unusual degree, if he wishes to assure his client absolute satisfaction.

History. The making of artificial marble was probably first practiced by the Florentine monks in decorating the interiors of churches in about the fifteenth century, and the results of their work may still be found in many beautiful old churches throughout Italy and over all Europe. When we consider that the plaster with which they worked was much inferior to that now available, we realize that they reached a remarkable degree of perfection, due largely to the great amount of time and painstaking care they were able to devote to their work. The exact process they followed is not known today except that it was very similar to the process used in this country up to a few years ago. The plaster was "retarded" or made slow-setting by the addition of a retarding material, usually some sort of glue. The coloring matter was then added, and the whole mixed and kneaded, as bread is kneaded, until the color was spread through the plaster in irregular streaks and veins. After the block thus

Insert and Mosaic Work is Cast in Large Sections

formed had been allowed to set partially, thin slices were cut off and applied to the surface to be marbleized. Being still plastic, it was possible to fit and mould the colored plaster to the surface desired. This, however, required a great deal of hand work in order to exactly fit the material together, to make the veining match and the surface even. In drying, these pieces often pulled apart from each other slightly, so that the early examples as they now exist show faint hair cracks between slices of plaster as originally applied. As labor costs rose, the process became less and less profitable, so that now very little, if any, of this kind of artificial marble, which is the true scagliola, is made. Another reason for its disuse is that the plaster does not form as hard a surface as the Keene's cement process does, although there are certain varieties of marble, such as Black and Gold, Verde Antique, and other marbles with dark grounds, whose color and veining can be more nearly reproduced by this process. However, as was said before, the cost in skilled labor is such as to exclude the possibility of its manufacture for commercial purposes. The most approved type of artificial marble as used today is made of Keene's cement. Although this is not properly scagliola, it is often spoken of as such. The manufacture was made possible largely through the introduction and development in England of a special Keene's cement which has never been equaled for the purpose of making artificial marble. The manufacture of this type of marble substitute is still practiced almost exclusively by Italian artisans, there being only about a dozen firms in this country employing a few score of these workmen in the making of the better class of artificial marble.



Artificial Marble is Especially Adaptable to Insert Work

Various Colored Cements are Distributed to Give the Effect of Mottled Backgrounds

Contracting for Artificial Marble. It seems that the decline of artificial marble making in this country as an art began when the building trades became unionized. The artificial marble workers were taken under the wing of the plasterers' union, and while this in many cases was beneficial to the workers, it also meant that artificial marble contracts were included with plastering contracts and sublet by plaster contractors. This tended to commercialize the business in many instances, whereas the importance of artistry should have kept this part of the work directly under the control of the architect.

Work done under sub-contracts which are peddled to the lowest bidder is usually unsatisfactory, since only labor and material of the highest quality should go into the making of artificial marble, and if the price is forced down by competitive bidding, such labor and material cannot be expected. The present high scale of wages in the building trades increases the temptation for less responsible contractors to skimp on workmanship and material. The more responsible firms have endeavored to maintain the high standards previously established, but unless the architect specifies in detail and insists on his specifications being followed implicitly, he opens the way

Column Shafts of Artificial Marble are Much Used for Bank Interiors

for firms without established reputation to compete, with their bids based on inferior materials and labor, and the reputable firms, in self-preservation, are forced to do likewise. This forced attempt to save invariably results in a loss to the appearance and finish of the work proportionately far greater than the saving effected. It would be as logical for the painting of the pictures which are to hang on the walls to be included in the general paint contract as it is for the artificial marble to come under the plastering contract. It is strongly recommended that the artificial marble be made on a cash allowance basis or under some arrangement which will give the architect absolute and direct control over the choice of the artisans and the supervision of the work.

The Modern Process. As to the best up-to-date materials and methods for the manufacture of artificial marble, it is perhaps universally admitted that for satisfactory results only the best English Keene's cement should be used for both facing and backing. The English Keene's cement is the only absolutely neutral cement available, and it has other properties which make it more nearly like marble when it has been colored and hardened. Artificial marble is produced by mixing superfine Keene's cement with the proper amount of mineral coloring matter, of proved permanence, to give a ground color to match that of the sample of natural marble which is to be duplicated. Skeins of silk fiber are then soaked in water in which has been ground mineral color to match the desired veining. This color-soaked silk is spread out on a smooth counter (for slab work) in such a way that some strands remain bunched together while others spread out thinly over what is to be the surface of the marble, the effect being remarkably similar to natural marble veining. It is at this point that a great amount of skill and care must be exercised by the workman. The surface coating of superfine Keene's cement is then poured over the threads to a thickness of from 3/16 inch to 1/4 inch. The silk threads which hang together are then carefully drawn out, leaving behind the coloring matter to form the markings of the finished marble. The silk is washed and saved to be used again. Cheesecloth is now spread over the soft cement and dry coarse cement sprinkled upon it. This tends to draw excess moisture from the mixture and gives it a slight initial set. The cheesecloth and dry cement are then removed, and coarse Keene's cement, which is usually pink in color, is mixed with water and poured on the facing cement which is still soft and with which it forms a perfect bond. Burlap reinforcing is usually included in this backing to give it added strength. The backing is poured to the required thickness (usually ¾ or ⅞ inch) and the whole allowed to dry for a few days. It is then rubbed, honed and polished much as is natural marble, except that all work must be done by hand, as the surface is

These Richly Polished Column Shafts are Over 25 Feet High

still somewhat soft and no machine has been found gentle enough to give the proper polish without scoring the surface.

Polishing. Care should always be taken to specify that natural polish be used, as cheap work is sometimes done with a shellac Process known as French polish. This is easy to apply and gives a high luster for a time, but is not at all permanent, and its use should not be permitted in connection with good work. It might seem that if good quality cement is used for the surface layer, the quality of the backing would not be of such great importance. This, however, is not true, since most cements are either highly acid or alkaline in their reaction. When such cement is used, even though it be as backing for neutral cement, the active agents in the cement will come to the surface, destroying the smoothness and partially obliterating the color. The use of cements of different degrees of strength is also likely to result in warping, since the shrinkage of the two will not be the same.

Moulded and Carved Work. Where moulded or carved work is to be executed, the process is similar to that described here except that a clay model is first made and a plaster or glue mould taken from it. The color threads are then spread about in the moulds and the fine and coarse cement poured as for the making of slabs. After the mould has been removed, the surface must be carefully pointed up and made smooth by hand, after which it is allowed to dry several days before being honed and polished. The advantage, from both an economic and a time-saving point of view, of casting a number of pieces in the same mould rather than carving each by hand from the natural stone, will be quite evident. One of the most important uses of artificial marble is as shafts for great monolithic columns, especially in theaters and banks. Obviously, these may not be made in the shop and then set up at the site, as are the smaller pieces, so they are made in place, the process being as for making slabs, except that the color threads are laid and the cement is poured on pieces of oilcloth instead of on the smooth counter. After the cheesecloth and dry cement have been applied, and the surface layer set to the right consistency, the workmen carry the oilcloth with its thin slab of plastic material to the member on which it is to be applied. This has been built up and brought to a surface approximating the finished form with rough Keene's cement, which may in such cases be mixed with 50 per cent of marble dust or fine sand. The slab, oilcloth and all are wrapped about the column or other moulded member and smoothed in place, the overlap being cut away or the gap filled, as the case may be. Great care must be taken that a perfectly smooth joint be made, and that the lines of the veining continue around the whole piece, as in a natural monolithic stone. As soon as possible, the oilcloth is removed and the

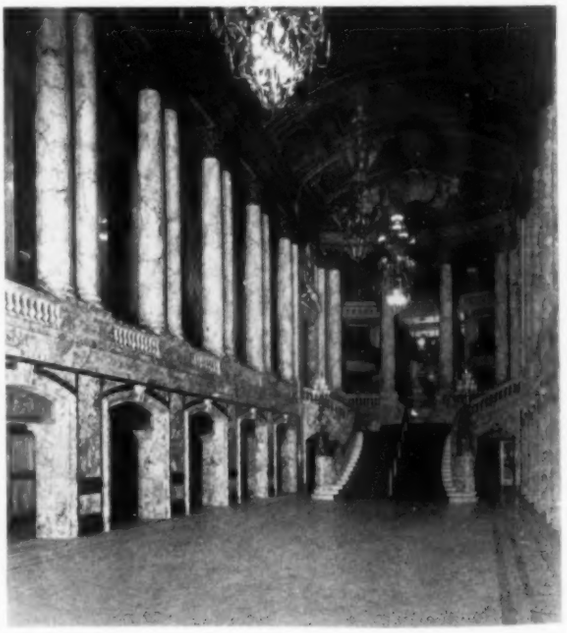
The Bank Screen is Real Marble, and the Columns are Artificial

surface made smooth and even. After this, a workman with a graving tool goes over it and "cleans up" the color veins, eliminating ragged edges and smoothing the surface. Great skill is required in this work, since the column must be brought to a true and even surface by hand alone. The entasis of the column must be carefully worked up and the whole thing brought as nearly as possible to a state of perfection. It is true that this perfection is not attained to such a degree as is the case with monolithic columns in natural stone, which can be turned on lathes and honed and polished in the same manner, everything being done with mechanical precision, but the slight irregularities and imperfections resulting from being finished by hand are not necessarily a disadvantage from an artistic point of view.

Lasting Qualities. As to the permanence of artificial marble, much can be said. The monasteries and churches of Italy, of course, were decorated with a different class or variety of artificial marble, the plaster process being much inferior to that in use today. Notwithstanding this fact, much of the work done then is still in a good state of preservation after over 500 years of service. In St. Peter's there are scagliola columns which are still in perfect condition and whose composition is never suspected by the thousands who visit the structure annually. The present Keene's cement process has been in use for only some 50 years, there being examples of work of about that age still in existence. Much of the older work in this material has been destroyed when buildings, of which they were a part, were demolished. Such buildings as the Waldorf-Astoria and the Bellevue-Stratford hotels contain much artificial marble, and the Brooklyn Trust Company's building contains some very fine artificial marble still in good condition after a period of about 18 or 20 years. It is said that artificial marble continues to grow harder with age, attaining a flint-like hardness after the passage of several years. In the shop of H. A. Cousins (now retired), who is considered the dean of the artificial marble industry and to whom is due much of the credit for its development in this country, a slab of artificial marble about 6 feet by 9 feet, said to be one of the largest slabs ever made in this material, was left standing for several decades. It was finally decided to divide it into smaller pieces for use, but it was found that it had attained such hardness as to make cutting impracticable.

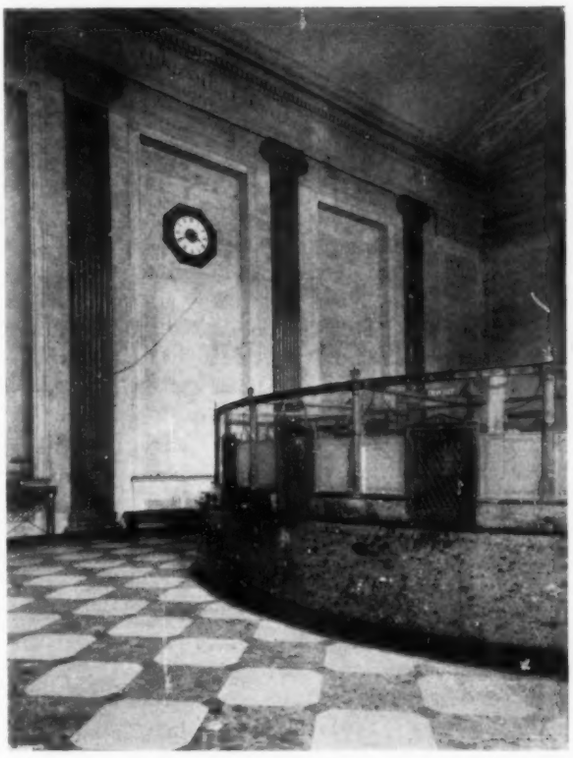
Limitations. It should be clearly understood that artificial marble should never be used for exterior work, and that even in interiors it should not be brought too near the floor where it will be subject to moisture from mopping or other sources. It is quite common practice to have a base of natural stone surrounded by wainscot and trim of artificial marble, the marble thus being protected from injurious direct contact with water.

Cost. Although, as has been explained, there are some cases in which artificial marble fills a



Artificial Marble is Combined with Genuine in Many Elaborate Theater Interiors

ired that cannot be supplied by natural stone, its chief *raison d'etre* lies in the economic advantages that may result from its use. These are probably becoming less and less as the highly skilled labor necessary for every step of its manufacture becomes scarcer and more costly. Natural marble can be worked largely by machinery, so that the proportion of its cost chargeable to labor is much less than is the case with artificial marble, when no machine work at all is possible. This high cost of labor has led in many cases to the cheapening of artificial marble by its manufacturers to meet the competition not only of one another but of the marble industry as well. For the purposes of this discussion, however, only such material as conforms to the highest standards, and which will compare favorably with the marble it reproduces, will be considered. It is not true that artificial marble is cheaper in all cases than its corresponding variety of genuine marble. Several factors govern the scale of comparisons between the two materials, one of which is the fact that all marbles can be reproduced in artificial marble at practically the same cost. The ordinary low-priced domestic marbles and some cheaper Italian varieties may be quarried and finished at a cost well below that of the same variety in artificial marble. As the value of the genuine marble increases, according to its coloring and beauty, while that of the corresponding reproductions remains about constant, a point is reached where the cost of natural marble becomes greater than that of artificial marble, making the substitution of the latter more and more desirable. Another factor affecting comparative costs is the degree to which the piece is to be moulded or carved. It is obvious that to produce a moulded object in clay and make a casting of it is vastly easier than carving the same object from a block of stone. Then, too, if the same mould can be used to cast several or a large number of pieces, the economic advantage of using artificial marble is increased almost in proportion to the number of the pieces. The type of work which affords the greatest saving and which is most often done in artificial marble is, of course, the making of large monolithic columns. Even if natural blocks of sufficient size could be obtained, the great difficulty in quarrying, manufacturing and transporting them would make their cost so great as in some instances to exclude the use of marble altogether. In such cases, if the column shafts can be made in artificial marble in connection with other parts of natural marble, a great saving may be effected without detracting from the beauty or stability of the work. Artificial marble is particularly adapted to use for insert work where a design is made up of a large number of pieces of contrasting marble. In such work, the various parts may be cast in a single block and thus bring about a worth-while saving in the cost of setting, at the same time insuring better joining of the pieces and a more lasting bond between them. In general, then, it may be



Ashlar and Artificial Marble Panels as a Background for Real Marble Pilasters

Artificial Marble Columns in the State Capitol of Idaho

said that it is advisable to use artificial marble only to duplicate: (1) very expensive marbles, or those difficult to obtain; and (2) for marble work that contains carved or moulded detail, especially if there be a large number of repeats.

The Architect's Responsibility. It seems that a great deal of the responsibility for the maintenance of the high standards in the artificial marble industry rests squarely on the broad shoulders of the architect. By specifying clearly and explicitly and supervising carefully artificial marble work under his control, he may force the artificial marble industry to do work such as will command the respect and admiration of all, or he may allow it to fall into such disrepute as to finally disappear altogether. Certain it is that for his own protection he should not allow work, which can produce such a terrible effect when poorly done, to be performed without taking precautions to insure the high quality of the result.

Details and Specifications. In general, work to be executed in artificial marble may be detailed exactly as for other stone or marble work. However, a draftsman who is equipped with a thorough understanding of how artificial marble is made, as well as of its limitations and advantages, is often able to detail the work in such a way as to take full advantage of the plastic qualities of the material and thus save considerably on the cost. A summary of some of the more important points and axioms governing the making of artificial marble may be found in a standard specification adopted by the National Building Congress, to be used by architects in the specifying of high class work. Among other things, these practices should always be insisted upon by the architect: (1) Use only the highest grade of English Keene's cement for both facing and backing, together with mineral colors of proved permanence. (2) Contracts should be entrusted only to workmen or firms of established artistic ability and prestige, and who can give satisfactory references as to work successfully completed. (3) After casting, the face should be dried up twice to insure hardness. (4) All work should be stoned twice and afterwards finished with a natural polish without the use of shellac or other surface applications. (5) The superfine surface coat should be not less than 3/16 inch thick, and should be applied to grounds or backing prepared the same day, to insure perfect cohesion. (6) There should be no visible joints where sections are joined, and veinings should continue around columns as on a monolith. (7) The surface should be brought to a perfectly even and fine line before honing and polishing. (8) The architect should reserve the right of rejecting all work not satisfactory up to one month from the date of completion, and it is not asking too much to demand that the contractor guarantee the work against defects of workmanship and finish for a period of at least two years.

In Installations Such as This the Presence of Artificial Marble is Never Suspected

It is Almost Impossible to Detect the Division Line Between Real and Artificial Marble

ELECTRICAL WIRING LAYOUTS FOR OFFICE BUILDINGS

PART II

BY

NELSON C. ROSS

ELECTRICAL ENGINEER, RICHARD D. KIMBALL CO.

MOTORS operating toilet vent fans, hood vents, and other motors at the roof may be under remote control with controlling push-button stations and pilot lamps in the superintendent's office, the boiler room, or elsewhere as desired. Separate circuits may be run from the distributing switchboard for the operation of each of the elevator machines, or two feeder circuits may be used, each of the required capacity for the combined load, these cables terminating in a transfer panel made up with double-throw switches and located at a central point in the elevator machine room. Tap circuits are taken from the panel to each of the elevator controllers, thus permitting the full operation of the elevators from one circuit in the event of breakdown of the other.

Motor service may be required for any or all of these services:

Ventilation	*General Power*
Fresh Air Fans.	Passenger Elevators.
Main Vent Fans.	Freight Elevators.
Air Washer Pumps.	Refrigeration of Air.
Ventilating Units.	Kitchen Refrigeration.
Kitchen Hood Vents.	Brine Circulation Pumps.
Cafeteria Vent Fans.	Vacuum Cleaner Plant.
Vent Fans for Assembly Hall.	Air Compressors.
	Repair Shop Motors.
Toilet Vent Fans.	Circulating Pumps for Drinking Water.
Vent Fans in Booths.	
Boiler Room Section	*Kitchen Section*
Vacuum Pump Equipment.	Dish Washer.
Boiler Feed Pumps.	Vegetable Peeler.
Motor and Ash Hoists.	Food Chopper.
Water Circulating Pumps.	Buffers and Polishers.
Coal Handling Equipment.	Knife Grinders.
Draft Fans.	Ice Cream Machines.
Stoker Motors.	Ice Crushers and Cubers.
Fire and Tank Pumps.	Individual Refrigerators.
Boiler-room Sump Pumps.	Cake Mixers.
Monorail Hoist.	Cake Beaters.
Oil Burners.	Electric Ovens, Ranges and Warming Closets, etc.
Oil Pumping Equipment.	

Available Service. In general, the lighting service will be delivered to the building over direct current or single-phase alternating current lines and at the standard lamp voltage of 110-115 volts. Lamp bulbs, small heating, and office equipment, if of the proper voltage, will operate equally well on either direct or alternating current. Depending on the location of the building and the development of the public service company's lines, motor service may be delivered over:

(1) Direct current, three-wire system at 115-230 volts, power being taken from the outside wires at 230 volts.

(2) Single-phase alternating current, three-wire system at 115-230 volts, power taken at 230 volts.

(3) Three-phase alternating current at 220-440 or 550 volts.

(4) Two-phase alternating current at 220-440 or 550 volts, four-wire service.

(5) Two-phase alternating current at 220-440 or 550 volts, three-wire service.

The standard frequency is 60 cycles. In certain locations, however, the service may be delivered at 25 or 40 cycles. Lamps, heating and office equipment, etc., will operate satisfactorily on these frequencies. Motors and motor circuits, however, must be designed to operate on the available motor service, and if alternating current, the motors must be wound for operation on the phase, voltage, and frequency of the service lines. If the service is to be supplied from a private generating plant on the premises, the character of the motor service may be selected. Even with the use of a private plant, it is good practice to select generating equipment corresponding to the phase, voltage, and frequency, as that used by the public service company, thus permitting of an auxiliary throw-over service with the company's lines, or the future purchase of the service.

Service Connections. It is advisable to provide an electrical switchboard room (even in smaller buildings) in which the service switchboard and master metering equipment may be installed, the riser and feeder cables passing from the service switchboard to, and connecting with the distributing switchboards, panels, wire closets, and other equipment. The switchboard room should be accessible from a public room or corridor, or from the outside of the building.

In certain cities local ordinances require an outside entrance to the switchboard room, giving the fire department access to the service switches. If this is impracticable, the control of the service switches must be within reach of a window, or it may be located under glass in the main vestibule or corridor, the service cables passing through the switches and terminating in the buss connections of the switchboard.

For smaller buildings the service switchboard room may approximate 8 by 10 feet in floor dimensions, with full head room. For larger buildings, a service switchboard room is necessary, and if the service switchboard is to be combined with the main distributing switchboard, a floor area of 25 by 40 feet or more may be required. The

Typical Service Switchboard for Large Building Showing Power and Lighting Sections

room height should be ample to permit the installation of large horizontal feeder conduits from the distributing switchboard to the wire shafts and equipment.

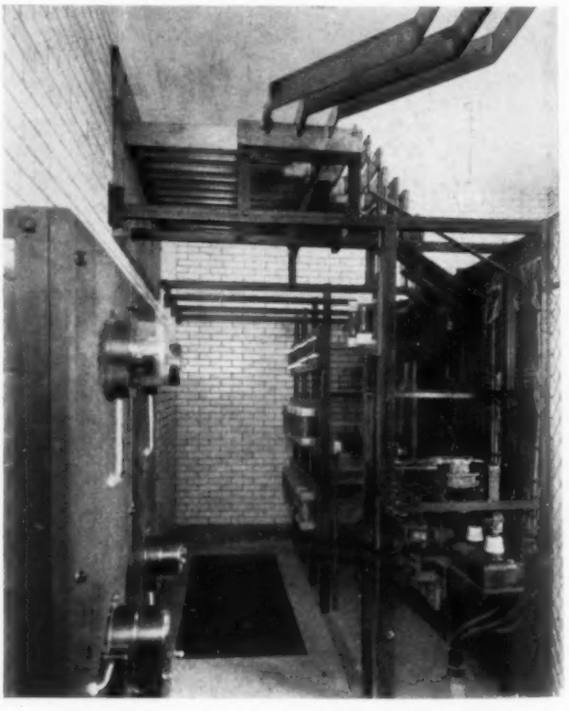
Service and Distributing Switchboards. For smaller buildings, the service switchboard may be developed with the use of fused safety switches mounted on a wood backing and interconnected with conduit and wires, or may be made up with fused switches in a steel cabinet, or it may be of the floor-standing type as desired. For larger buildings, the floor-standing type will be a necessity, made up with slate panels and the required number of fused knife switches, and circuit breakers, instruments, etc., for the control of the feeder circuits and mains. The board, as a rule, stands approximately 6 feet from the wall with buss connections and fuses mounted at the rear of the panels, and with separate panels for control of the power and lighting feeders.

The "service metering equipment" may be mounted on separate panels as a part of the switchboard, or it may be on a separate switchboard in the service room. The switchboard room should be located at the point of service permitting the service cables to enter the room directly from the street, or from the transformer vault. If a vault is to be used, the switchboard room should be a part of the vault, and it should be separated from it by a fireproof partition.

For larger buildings a distributing switchboard must be considered, this located in a separate room on the basement or sub-basement floor, and at a point central for the load, the switchboard being made up in two sections mastering the power and lighting services respectively, and equipped with fused switches or circuit breakers connected to control each of the sub-feeder circuits or risers leading from this switchboard to the meter closets, panel boards, and motor-driven equipment. Where the voltage of the motor circuits exceeds 230 volts, sub-feeders should be mastered from oil circuit breakers on the power section of the switchboard. Sub-feeder conduits leading to the distributing switchboard may terminate in a steel junction or pull box over the switchboard, the wires of the sub-feeders passing through bushed holes in the bottom of the box and connecting with the circuit breakers and switches.

Transformer Vaults. If the available electric service is to be "direct current," the cables will enter the service room directly from the street, and terminate in the master service switches, one or more cables being installed as may be required for capacity, or to provide for emergency service. With the use of alternating current, the company may provide transformers in pits on the street, or on poles (if the service is "overhead"), or the company may require a private vault on the premises, or incorporated in the building. For other than small buildings a private vault is preferred.

The vault must be of fireproof construction,



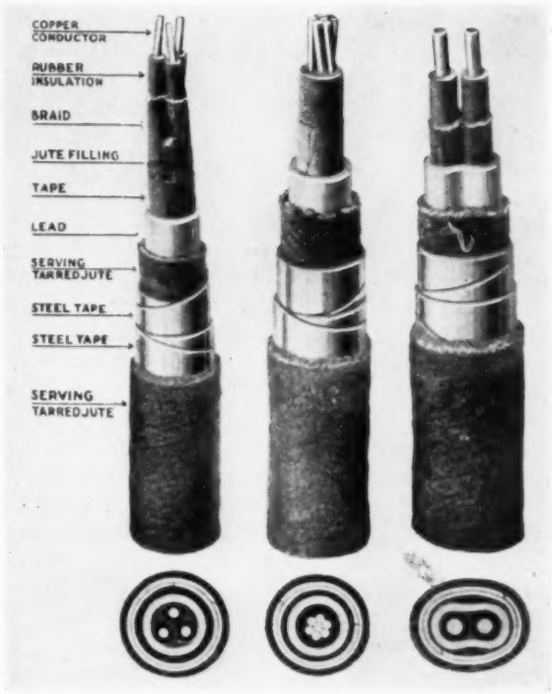
Rear of Same Switchboard, Showing Buss Connections to Transformer Vault

with cement floor and ceiling and with walls of cement or of brick; it must be vented to the outside of the building, equipped with a floor drain, underwriter's door with lock, and with a 6-inch cement curb at the door to prevent the escape of oil in the event of there being defective transformers. Where possible, the entering door should be from the outside of the building. If this is impracticable, then from a public service corridor or from the boiler room, as approved. Where possible, with the use of an inside vault, the outer wall of the building should form one wall of the vault and be so arranged that the primary cables may enter the vault directly from the street. Where it becomes impracticable to locate the vault at the outside wall, the conduits and primary cables must be carried from a point outside the building under the floor to the vault, or the primary conduits must be surrounded with 12 inches of masonry to the approval of the company.

The required floor area will depend upon the number and capacity of the transformers required, approximating 8 x 10 feet with 7-foot head room for installations, not exceeding 100 K.V.A. with proportionately greater floor area as the capacity of the transformers is increased. The size and arrangement of the vault must have the approval of the company for each installation. Regardless of the location of the vault, provision must be made so that the transformers may be readily removed and replaced.

Service Cables. The type and construction of the service cables, as well as the method of bringing these cables into the building must, in each instance, be to the approval of the service company. The service cables must extend from the company's lines on the street or public right of way to the transformer vault, or to the master service switches. In the event of the service being "overhead," the company will extend the lines to some determined point near the building, and from the service pole the cables may enter under ground to the vault or the service switches.

With underground service the company will bring the lines to a service pit on the street, from which point the service cables will enter the building as just explained. As a rule, the company will bring the service to the property line at its own expense. All service cables on the property will be at the expense of the building's owner. A splicing pit will be required at the curb, with either overhead or underground service. Where underground service cables pass under cement walks or roads (between the service pit and the building), underground conduits must be used, made either of tile, galvanized iron or of wood fiber, these being laid in trenches, in straight lines and to grade. Splicing pits will be required in the lines at intervals of not exceeding 200 feet and at offsets or where the line changes its direction.



Cross Sections and Partially Stripped Sections Showing Construction of Parkway Cable

Where, as in outlying districts, the service cables may be under lawns and shrubbery, and at right angles under walks or roads, Parkway cables may be used, these laid in single lengths without pits, between the building and the service pit at the curb. The Parkway cables are sheathed with lead over the insulation, are protected with steel tapes, and saturated jute servings, and are laid in trenches without further protection. Where Parkway cables pass under roads or walks, pipe sleeves may be used, and the cable passed through them, permitting the removal of the cable in the event of breakdown without disturbing the road. This also applies to Parkway service cables where they pass under the floor of a building to an interior service room, as pipe sleeves must be provided to permit the cable to be removed in the event of accident without the necessity of opening the floor.

Provision for Low Tension Equipment. Complete low-tension equipment may include public and private telephones, electric clocks, bells, paging equipment, office signal and annunciator systems including time clocks and time stamps, etc., as well as fire alarm and watchmen's clocks, and provision for A.D.T. and Western Union service wiring. With smaller office buildings, low-tension wiring may include only provision for public telephones, watchmen's clocks and possibly provision for A.D.T. or Western Union service. With larger buildings, particularly when occupied largely by one tenant, all of these may be called

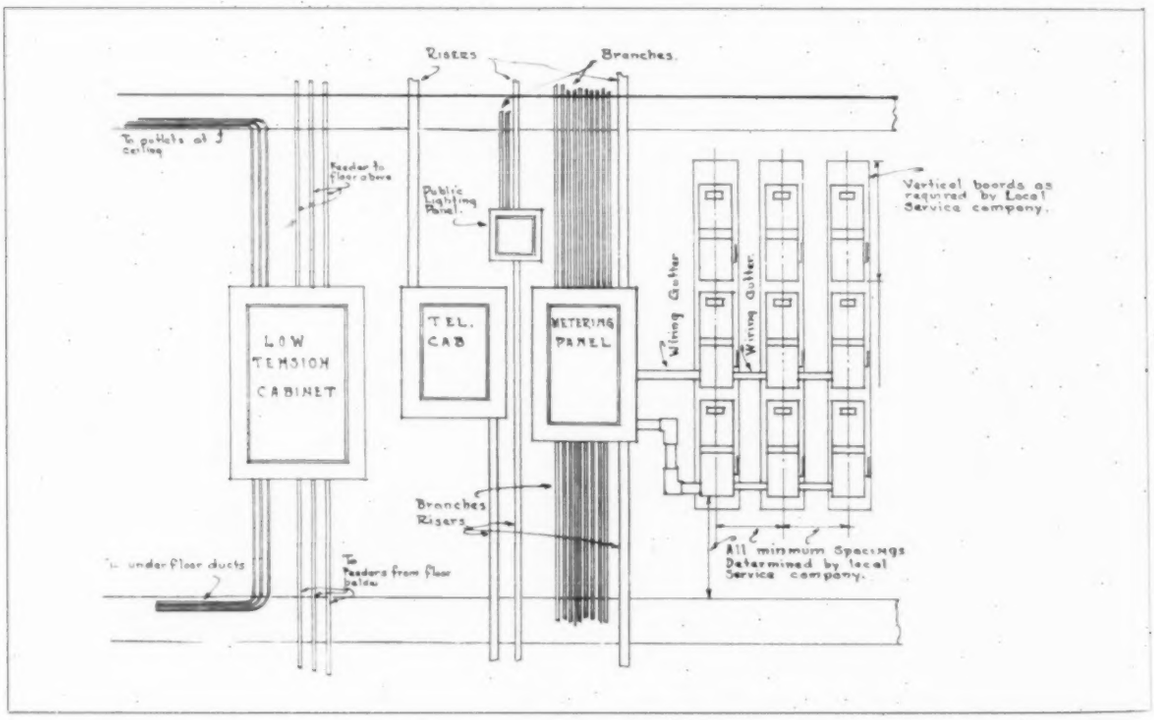
for. In general, the outlets for fire alarm and watchmen's clock stations, bells and electric clocks, etc., may be permanently located, as these outlets may occur in public corridors, on columns, or on permanent walls. Outlets for office equipment, however, may not be permanently located, as there are no fixed locations for desks, and the furniture layout will be changed by tenants.

Public Telephones. In general, provision for public telephones must include a raceway of empty conduits, terminal cabinets, and junction boxes, in readiness for the installation of terminal strips and telephone wires. The conduit raceway must be installed to the approval of the telephone company by the building owner, all required telephone wires, terminal strips, and instruments, etc. furnished and installed by the telephone company.

Where meter closets are to be used, terminal strips and cabinets will be located in the meter closets, on the respective floors. Where, in smaller buildings, meter closets may be omitted, the terminal cabinets and terminal strips may be mounted on the wall of some public corridor, on one or more floors. The size and wire capacity of the terminal cabinets will depend upon the maximum number of instruments to be served. Sizes may be obtained from the company upon request. The telephone service conduit will enter the building at the point determined by the company, usually terminating in a steel service cabinet in some service corridor or in a room accessible from a public corridor, and near the point of entrance.

The dimensions of the service cabinet may approximate 6 x 10 feet by 12 to 18 inches in depth, depending upon the service. The cabinet must be equipped with wood back and fitted with steel doors under lock. A separate compartment may be provided in the service cabinet for the wires of the A.D.T. and Western Union services. In very large systems a service room is to be preferred. From the service cabinet, riser conduits must be carried to the terminal cabinets in the meter closets or in the corridors, and the cabinets looped vertically on the conduits. Riser conduits must be proportioned for the sizes of cables. These conduits are seldom smaller than 2-inch, are run without bends, and connect to alternate sides to provide spare riser conduits, permitting the installation of cables without sharp bends. Where bends or offsets occur in the risers, junction or pull boxes should be used to the approval of the company. Expense permitting, it is good practice to provide spare riser conduits, permitting the later extension of the system.

All this construction will, in general, apply to all types of office buildings with a few exceptions. With larger buildings, meter closets of ample sizes should always be considered, as large terminal cabinets on the corridor walls will prove unsatisfactory. Where, due to the floor area, two or more meter closets may be used on a floor, separate conduit risers should be run from the services to each of the meter closets on the lower floors and loop vertically through the terminal cabinets in the



Typical Arrangements of Meter Closets

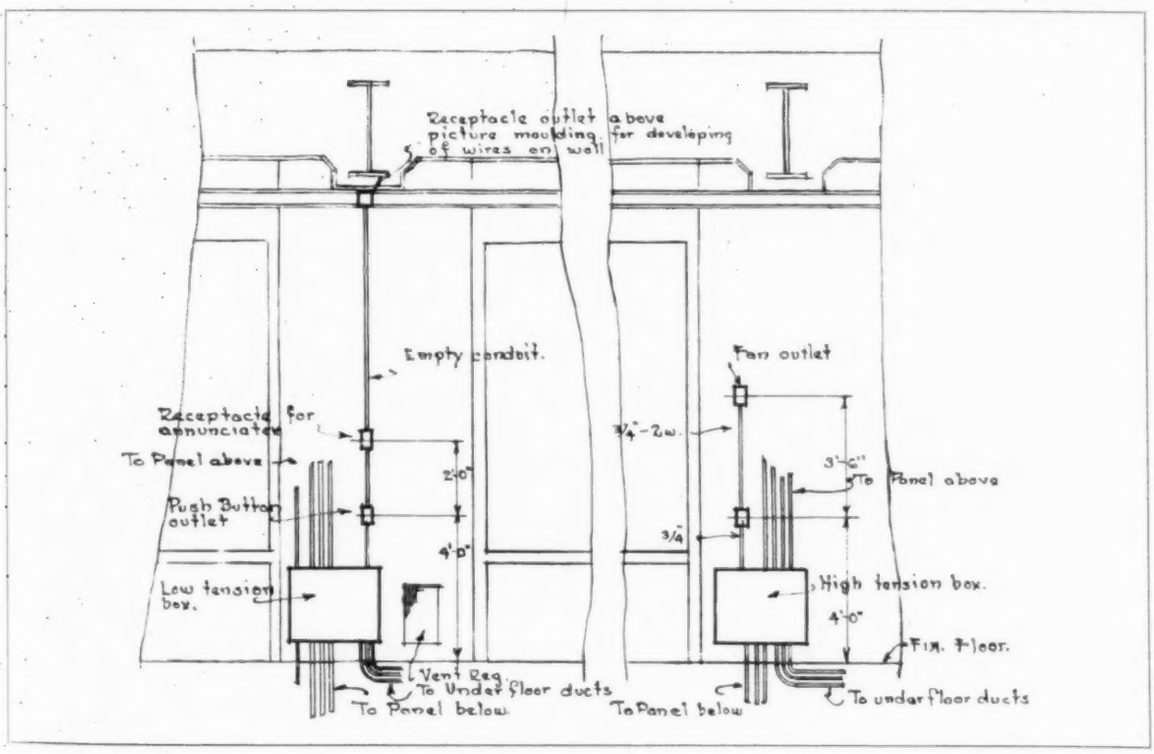
meter closets on the upper floors of the buildings.

Where, as with a large office building, occupied largely by one tenant, a private branch telephone exchange may be required, the exchange and wire service room should be as near the center of the building as is possible. With this construction, the service cables are carried into the building through a service junction at the point of entrance, passing from the junction direct to the service room at the exchange, and developing in conduits from the exchange to the distributing terminal cabinets in the meter closets. With this construction, the wires of the A.D.T. and Western Union services are taken from the telephone service cable at the time-service junction, and pass through a separate conduit raceway to the low-tension cabinets in the meter closets. Adequate junction or pull boxes must be used in all service telephone conduits, at all bends, and in all lines exceeding 150 feet between cabinets or terminals.

Branch Telephone Circuits. One method of outlet wiring for office telephones provides fixed conduit outlets in the permanent walls and on columns, setting the boxes at points above picture mouldings, and also at the baseboard, connecting these outlets with conduits and running conduit from the feeding outlet to the terminal cabinets in the meter closets or in the corridors. In making connections to the office instruments, the wires pass through a bushed hole in the cover of the outlet box and are run exposed on the baseboard or behind picture mouldings to the instruments. While flexible, this method is more or less bulky, and it requires a large number of outlet boxes, as well as large conduits for development of circuits.

A more simple arrangement employs the use of a deep picture moulding set at approximately 4 inches below the ceiling on all walls throughout the corridors and offices, public space, etc., and the further use of 2-inch fiber tubes through all walls and partitions, these tubes set flush with the face of the walls, and aligning with the wire space of the moulding. From the terminal cabinets 1½-inch conduits pass in the construction to junction boxes set flush with the walls and at the rear of the wire mouldings, separate conduits being used from the terminal cabinets to the mouldings on each side of the corridor. The telephone wires pass from the terminals, through the conduits to the mouldings, and are concealed in the wire spaces in the mouldings, passing from room to room through the bushings or tubes. The mouldings are drilled where required, and the wires are run exposed to the instruments.

Further flexibility is secured by the use of vertical 1½-inch conduits at intervals of 50 feet in the corridors, these looping through junction boxes at the rear of the mouldings, permitting the ready installation of low-tension wires between the offices on the different floors. This equipment



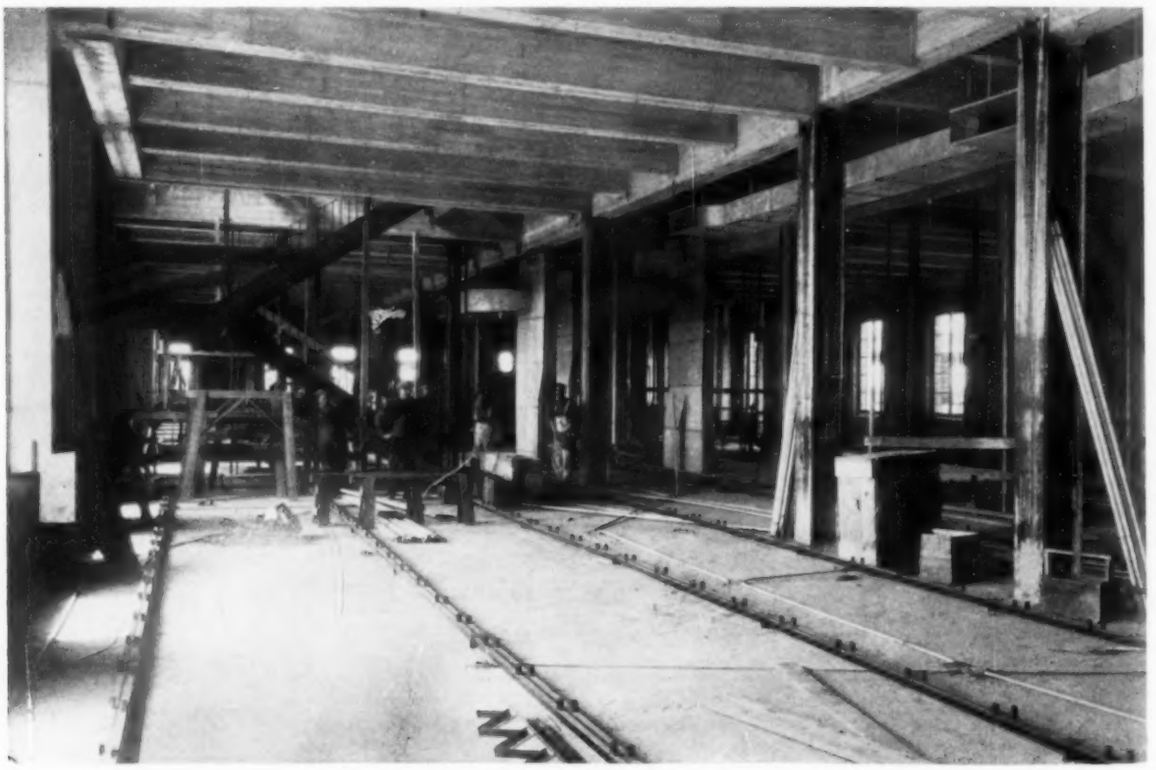
Arrangement of Outlets at Each High and Low Tension Cabinet of Underfloor Duct System

is inexpensive to install; the wire capacity is limited only by the sizes of the conduits and the wire space provided in the mouldings.

Underfloor Raceways. These methods of telephone and low-tension wiring work out well in limited areas, as desks may be set reasonably near the windows and columns. Instruments may be used on the desks, with ringers and like equipment mounted on the walls. Wires, however, where run exposed may be objectionable, even though installed in metal mouldings. Larger office areas with desks and other furniture not in proximity to the walls and columns, will require service from the floor. The use of standard floor boxes and conduit wiring does not always prove satisfactory for this service, due to the sizes of conduits required for the development of the underfloor wiring, and the necessity for three separate conduit services for all floor outlets.

In general, the most flexible underfloor wiring may be had with the use of underfloor steel raceways consisting of a network of rectangular steel ducts, junction and crossover boxes and steel tube inserts, etc., the whole being embedded in the floor slab so that the tube inserts and covers of the junction boxes are flush with the finished floor. The system may be designed to cover the whole floor area, or such portions of the floor as may be required for special work, and ducts may be laid parallel with the walls and for full coverage may be spaced from 4 feet, 6 inches to 6 feet apart, depending upon the locations of the columns and the space available for desks, etc. Junctions or crossovers should be spaced not more than from 25 feet to 40 feet in the duct lines and home run ducts of feeder conduits taken from the nearest junctions to the meter closets, and connecting with the cabinets and panelboards. The system may be designed with the use of one, two, or three ducts, depending on the coverage and flexibility desired. Separate ducts, however, will be required for the wires of the lighting, telephone, and details of miscellaneous low-tension office equipment.

For maximum flexibility and full coverage, the "three-duct system" should be considered, consisting of two 3⅛x1¼-inch ducts and one 1¼x1⅞-inch rectangular steel duct, providing three separate steel underfloor raceways for the wires of the lighting, telephone, and miscellaneous low-tension systems. The junction boxes may also be so arranged that pipe conduit runouts may be taken from the junction boxes to feed special outlets on the walls and columns (where a single service may be required) or to cross connect the duct system with subordinate panel cabinets or connecting boxes. The three-duct systems are fed and extended through single three-duct junctions and crossovers, partitioned so that there is no in-



Two-Duct Metal Raceway Being Installed

intercommunication between the three systems, the crossovers and junctions, ducts, etc., requiring not more than a 4-inch slab for installation.

By the use of auxiliary panel cabinets at intervals in the walls of the different floors, connected with vertical conduits, and the connection of the cabinets with conduits to the duct system on each of the floors, the system, combined with the meter closets, becomes an underfloor conduit raceway throughout the entire building, permitting any reasonable combinations of wiring between desks on one or more floors without the necessity of cutting floors for the installation of conduits.

Tube inserts are built into the ducts in the process of manufacture, and no drilling is required for the installation of equipment. Special receptacle heads are provided (these fitting with expanding couplings in the tube insert) for desk lights, telephones, and low-tension office equipment. With the installation of wires, it is but necessary to remove the covers of the required crossover boxes, as well as the caps of the insert tubes at the desks, the wires being readily fished and final connections made at the respective cabinets in the meter closets.

Where partial coverage only is required, and it is not desired to develop the three-duct system of underflooring wiring, a two-duct or single-duct system may be used with the usual junctions and crossovers, and may be connected with meter closets or with standard panel boards of the lighting service.

Electric Time Systems. The development of an electric clock or time system synchronized from some central point of control is almost a necessity in modern office buildings, since it provides for accurate and uniform time at all outlets of the systems and permits of the development of office clocks, time stamps, employes' time clocks and like time equipment. With outlets for synchronized time available in all offices, and throughout undeveloped office space, clocks and like equipment may be connected to the system or removed at will, and the time system readily developed to meet all requirements of tenants. The time service may be included in the office rental, or clocks may be installed at the request of the tenant at a fixed annual charge. The time system may be designed to operate on alternating current circuit from the lighting service, or for direct current and operated from a central storage battery. The wiring with either system will be substantially the same.

While round metal case secondary clocks with either 8-, 10- or 12-inch dials are in general use for office work, secondary clocks of any design and finish are available, and also in either the floor, desk, or semi-flush wall type. Secondary clocks in general should be considered for offices, corridors, elevator lobbies; special offices and rooms, and in assembly halls, gymnasiums and cafeterias. If large outside bracket clocks, pedestal, or tower clocks are to be considered, these may also be readily operated from the time system and under synchronized control from the master clock. Where tower clocks are to be illuminated, the illumination may be under automatic control of the time system. The master clock and program movement may be in some public office, usually that of the building superintendent; the storage battery for the operation of the time system may be in a room convenient to the clock or in the switchboard room of the lighting service.

Master Clock. The master clock controlling a large installation will, in general, be of the floor type, with three compartments containing the clock, the program movement, and the transfer board equipment respectively, the whole designed to conform to the surrounding finish. For large installations, the clock may be equipped with ten or more circuits with the corresponding number of circuits for the program movement, and the plugging or transfer board will require floor space of approximately 2 x 10 feet.

Wiring. All circuits of the time system should be run with rubber-covered wires in conduits, branch circuits being of No. 14 gauge, branch circuits on each of the respective floors running back to and connecting with the terminal strips of the low-tension cabinets in the meter closets. Branch circuits should loop through the clock outlets with not more than ten outlets connecting to the circuit. Circuits to desk outlets will develop from the low-tension cabinets through the duct system to the desks. Riser circuits from the master clocks pass to the meter closets on the lower floor, looping vertically through the meter closets on the upper floors, connecting through the low-tension cabinets to all circuits of the time system.

Separate circuits are, as a rule, carried from the master clock for the control of outside bracket or pedestal clocks and also for tower movements. Six No. 10 or even larger wires may be required for the control of the tower movement and illumination. Service wires from the battery to the master clock will depend upon the load and the distance from the battery to the clock. In general (for large installations) these wires are not smaller than No. 4 gauge. A separate circuit of two No. 12 wires must run from the master clock to the battery for the automatic operation of the battery charger. General battery current may be provided at each of the low-tension cabinets in the meter closets by means of riser circuits from the battery (not less than two No. 4 wires), the battery circuits looping through each of the low-tension cabinets, and providing battery current for miscellaneous low-tension office equipment.

Where, due to the type of the building, and the

location of the master clock, the clock and bell circuits exceed some 300 feet in length, the relays may be located in the meter closets at some central point rather than in the master clock, the primary circuits from the master clock operating the relays which take current from the battery wires for control clocks and low-tension equipment.

Corridor Gongs. With the use of a building largely occupied by one tenant, corridor gongs may become a necessity, as these gongs, operating on a schedule from the master clock, direct the employes where group control is desired. The gongs should be located at central points, wired in multiple, using No. 14 wire in conduits feeding back to the low-tension cabinets in the meter closets and from the program clock. Where a common schedule is used, with all bells ringing upon the operation of the relays, the gongs may be connected in multiple on a two-wire circuit. When, however, it is desired to change the schedule of any individual bell or group of bells at will, a plugging or transfer board must be used at the clock, and the gongs are connected to a common wire with a separate wire from the plugging board to each and every gong.

Storage Batteries. The capacity of the required storage batteries will necessarily be determined by the size of the time system and the equipment to be operated therefrom. As a rule, the battery required for a large installation will be of not less than 300-ampere hour capacity, at 24 volts. A duplicate battery should be considered, as well as duplicate charging equipment from the master clock. The battery should be furnished with controlling switchboard fitted with the usual equipment, including instruments, circuit breakers, and fused switches for control of time and low-tension systems.

Interior Telephones. The wiring for interior telephones and office signaling equipment, etc., cannot well be included in the wiring layout of the building, without exact information as to the location of desks and the scope of the equipment desired. With the use of under-floor raceways and telephone corridor and office mouldings, these in turn connected with the low-tension cabinets in the meter closets and on the walls, the wires of the local systems may be readily installed and connected as desired.

Watchman's Clocks and Fire Alarm. The combined watchman's clock and fire alarm system (A.D.T. or like service) will include an empty conduit raceway, (usually ¾-inch conduit) with connection to the gongs, station boxes, the control station and the point of service. The gongs and station boxes will be set in the stair halls, corridors, boiler rooms, large storage areas, basements and elsewhere as may be required to insure the complete coverage of the building by the watchman in his rounds. The exact location of the boxes will be at the approval of the company. The company will furnish the box grounds or casings and deliver them to the building ready for installation in the rough by the electrical contractor. The boxes are set one over the other on the different floors and are connected in series on the conduit risers, with cross connections run in the sub-basement space.

The gongs and stations as well as all cable and equipment will be installed by the company at the completion of the work. It is good practice to provide a lamp receptacle on the wall and at a point over each fire alarm station. These receptacles are fitted with red lights of small wattage, the lamp being kept burning to indicate the character and location of the station. With the use of a private watchman's clock system the locations will be the same, with the clock in the office of the building superintendent. Stations may be of the magneto type and set flush with the walls, connecting with the common wire and an individual wire from each of the stations to the clock. Wires should not be of less than No. 16 gauge rubber-covered wire. The use of the private fire alarm system will necessitate the same conduit raceway as noted here for the combined system, with the master station located in the superintendent's office, the boiler room or some convenient point, and with battery service furnished from the storage batteries of the clock system.

Paging System. These systems in general may consist of a series of single-stroke gongs or sounders located throughout the corridors and elsewhere as required, these sounders being connected on multiple circuits (with No. 14 rubber-covered wire in conduits) the circuits carried back to the meter closets on each floor. From the nearest meter closet the master circuit is carried to the exchange telephone switchboard and connected to the control from a master call station which sounds the required call signal on all of the sounders until the individual called communicates with the exchange switchboard. The system may cover the whole or any part of a building as desired, and may be operated from the exchange switchboard or from push-buttons in the superintendent's office or from some central point as desired. The system may operate from the lighting current at 110 volts or from the low-tension system at 24 volts. With the use of push-buttons at the entering doors, the button circuit may be extended to the master call station at the exchange switchboard, thus sounding the paging gongs or sounders from the door when the building is locked, and notifying the watchman that he is wanted at the door.

THE ARRANGEMENT OF SPECIFICATIONS

BY

ERNEST O. BROSTROM

FIRST, there came the standardization of general document sizes. 'Twas a boon to get away from the mixed papers, letters of any old dimensions, contracts of legal cap size, and end-rolling specifications that reminded one of ancient papyrus scrolls. And catalogs! Scramble every letter and punctuation mark, and they could not adequately represent the confusion of the architect's file of—say—a decade ago. Then came the American Institute of Architects with the "standard filing system for information on building materials and appliances." It has been tried and—lives. The creators of sales publications have not found it excessively difficult to produce folders and catalogs of uniform dimensions, nor to arrange them so that they can be easily placed in the proper divisions of the file, and, in turn, be readily resurrected when wanted.

Thus there has been a steady advance toward order in this part of the architect's business. For himself he demands that others shall present their information in a thoroughly ordered manner. Fine, but is he giving out as he is receiving? Assuredly some offices are producing work thorough and complete in every detail. This is almost universally true of the drawings. The specifications, too, are subdivided in close approximation to building progress. But the arrangement of the divisions themselves within the specifications? Can you go to your brother architect and turn to a particular item of the work and find it in the subdivision of his specification in which you carry this item in your own? No. Neither can the contractor!

It is a very simple matter to re-arrange a specification sequence so that the various sections tally perfectly with the numerical numbering of the A. I. A. standard catalog classification. The page numbering of the sections and many of the paragraphs may quite readily bear the file number corresponding to that of the A. I. A. classification. Then a salesman will know exactly where to find the specification bearing upon his interests. His sales book and your file and the specification carry the item or items in the same order. The contractor will know just where to turn in a specification for any particular portion. Jones & Jones' specifications and yours, and Debilicale's, all following the same general arrangement, will facilitate estimating. The general order of the estimator's take off will become the same as the specification order,—not only for one office, but for all offices, and that as widely as this orderly practice may extend itself. The standard classification sequence will become an index that is already very natural and will easily be remembered.

To illustrate. The general conditions may be ordered much like the A. I. A. standard documents and bear a prefix letter or letters.

Section 1.—Preparation of Site. There are always items that come under this heading.

Section 2.—Excavation. Occasionally there comes a job when there is no earth work; then this section naturally does not enter into the specification and is omitted.

Section 3.—Masonry Materials. In the usual specifications the materials for the various masonry contracts are carried under each respective head, but there seems no adequate reason why this classification should not stand.

Section 4.—Concrete. And so it goes on down the entire numerical order.

Paragraphs, too, may bear an exact identifying number, for instance:

Forms, Wood—4 d 2.

Reinforcing Steel—4 e 22. Identified at a glance, to the initiated, as referring to high carbon steel. Introduce your own numbers as needed, reserving the main classification as a guide.

A plumber desires to figure his work. He turns to the 29th Section. He soon learns that that is where his work is to be found. The metal door man will know he is to look in Section 16, for so his catalog is numbered.

A glance at your own copy of the A. I. A. Document No. 172 and a review of your most convenient specification will indicate the ease of adopting this classification order for your own. The wisdom of the result will prove itself in a short time, especially if this order of specification sequence is extensively adopted. In order are found facility, comfort, strength, precision, assurance and economy.

EDITOR'S NOTE. In order to illustrate one way in which the suggestion may be carried out, we have reproduced in facsimile, at nearly full size, a page from one of Mr. Brostrom's specifications. On the original copy the A.I.A. classification was indicated in pen and ink on the margin. Copies were made by blueprinting. The main classifications are indicated in the upper right corner of each page, in this case A.I.A. 19. The figure (2) indicates the second page of the specification covering Major Division 19. Carpentry.

AIA 19-(2)

MILL WORK

DOORS: 19e12

The fire escape doors to be heavy construction of white pine.

The doors where glazed to have 1/2" dividing muntins.

The interior doors, except those already specified as of metal, to be of plain 2-panel B & C.fir style birch panel veneered door of standard manufacture, except that the main doors in all rooms from corridor are to be equipped with a standard American sash or equipped ventilower of approved type. Doors marked Gl. are to be glazed.

FRAMES: 19e13

The exterior frames to be built of W. P. per drawings, all well put together with rabbeted 1-3/4" solid jambs.

Interior wood jambs, cased openings and frames to be worked to the details. Plain 7/8" jamb Y.P. with square edged stops nailed in place.

WINDOW FRAMES: 19e13

Box frames to be standard brick frames and may be built of Y. P. except brick mold and sills which are to be of cypress. Equip with weights and sash cord and anti-friction pulleys. Frames resting on masonry are to be bedded in mortar.

All frames are to be prepared for interior trim of same finish as room in which they are located.

SASH: 19e11

Check rail sash shall be 1-3/4" as marked. with 1-1/4" between glass in the check rail, all of white pine. Muntins, where shown, to be 1/2".

All sash shall be rabbeted on outside for glass; all sash shall be mortised and tennoned together and pinned, all to be well glued. Any interior sash shall be of same finish as that of the room in which they occur.

INTERIOR FINISH: 19e3

All interior trim for doors, windows, etc. shall be Y. P. strictly clear finish materials free from all defects, all machine sanded mouldings, hand sanded.

SPECIFICATION PAGE, SHOWING A.I.A. CLASSIFICATIONS

THE SUPERVISION OF CONSTRUCTION OPERATIONS

BY

WILFRED W. BEACH

CHAPTER 10. CONCRETE REINFORCEMENTS AND OTHER BUILT-IN MEMBERS, CONTINUED

EDITOR'S NOTE. *The considerations of the placing of reinforcement were taken up in the previous article (October, 1929) and are here continued, the discussion centering on the various provisions made by specification writers regarding the placing of sleeves and boxes.*

A SPECIFICATION writer who is lax in properly correlating these functions should be cautioned and made to correct his practice. The chief reason for having the contractor for each trade provide his own sleeves and boxes is that he is best able to forecast his requirements at the time of compiling his bid and make proper allowances, while a general or concrete contractor must simply guess high enough to be safe. This does not apply to estimating for duct work, the necessary openings for which are generally shown on drawings as of definite sizes and at definite locations. For these and other larger members, wood boxes are ordinarily built into forms so as to be easily removable.

It is not unusual for a superintendent to discover that no adequate provision has been made, however, for treating the interruption of reinforcement due to locating holes larger than the distance between reinforcing members. He must look ahead to this and, if necessary, get special instructions from his home office and see that they are carried out. Hit or miss location of large holes in slabs at the behest of any and every trade is careless practice and not to be tolerated. An experienced superintendent knows that the value of any tension or shear member in concrete lies in its continuity, and that they are not to be cut or deflected without specific instructions. Minor members may be slightly deflected around small holes, but larger holes (depending upon the computed live load and the relation of the hole to the location of the reinforcement) may need special treatment of reinforcement and should be investigated in ample time.

Among the items that must be thus located and maintained in the forms with extreme accuracy are sleeves for all manner of piping, conduit, shafting, ducts, chases, etc.; anchors for veneering; furring, stripping, machine foundations and equipment of every description, boxes for floor-inserts, cabinets of all sorts, etc., etc., *ad infinitum*. The superintendent must familiarize himself with the work to such an extent that he may be sure that nothing has been neglected. The omission, improper installation or accidental displacement of any one of such members spells subsequent grief and probability of undue cutting and patching.

For example, a contract for the installation of an automatic sprinkler system in a reinforced concrete factory building was let as an afterthought by the owner. The pipe anchor inserts were sent to the site by this contractor to be placed by others. The owner, to avoid an extra on the general contract, employed his own house carpenter to set these inserts in the forms, depending upon the architect's inspector to watch him. The inspector checked some, but not all of them. Later, when the pipe setters attempted to make use of the inserts, they found several series to be so out of alignment as to be useless, and, hence much cutting for new anchorage was necessitated, all at the expense of the owner. He was inclined to place all blame on the inspector (where some of it belonged), but was made to see that, in having had work done direct, instead of by the contractor, he was taking to himself the responsibilities that would otherwise have plainly rested upon the latter individual. The architect was fortunate in having a client more than usually amenable to reason.

In accordance with the terms of the specification paragraph which demanded that "a competent mechanic (more, if necessary) shall be exclusively and continuously employed, before and during pouring, in the correcting and replacing of reinforcement and other members to be embedded, which may have been displaced, and shall keep just ahead of the pouring," our superintendent took the earliest opportunity to have the general foreman assign a man of sufficient intelligence, experience and interest in his work to be dependable in the matter of properly adjusting chairs and reinforcing, cleaning and strengthening forms and rectifying everything else that needed attention just prior to pouring. Unfortunately, there was (as ever) a continual temptation on the part of the foreman to consider this man insufficiently employed, but the superintendent used a firm hand and kept control of him. He was especially particular to see that all intersections of members were wired together to the extent specified; that all splices were of requisite length and not in forbidden locations; that all bulkheading was properly done and all concrete and other surfaces in proper condition to receive the new flux; that all open ends of pipe, conduit and wall slots were well plugged, and that all sleeves were similarly stopped, or filled with sand or paper to keep out the concrete. As a result, they had but one case of serious form

leakage and but slight trouble elsewhere. There was no effort to "cheat the mix" and, by using this assigned man to make all slump tests, they were able to keep things moving at a good rate.

Some difficulty was experienced later on in the placing of wire fabric in the various slabs where this light weight reinforcement was called for. The men tried to unroll the material in place, but could not eliminate the bends and kinks to the satisfaction of the superintendent who insisted upon their taking it out to the street paving, unrolling and turning it over, then smoothing the curved wires by hand to the degree necessary to permit the mesh to lie flat. By so doing, they found that it would "stay put," and that time was saved with this troublesome material. Many contractors prefer to buy wire mesh in flat bundles, perhaps not so easily handled, but certainly more easily deposited and maintained until covered.

Where anchors are to be set by templates, as for machine foundations, hardware and the like, the superintendent should ascertain well in advance that the templates as well as the members to be embedded are on hand and that the foreman understands just how they are to be placed. Frequently, even a small mistake is disastrous.

CHAPTER 11
WATERPROOFING AND DAMPPROOFING

EARLY in the process of preparing drawings and specifications for a given work, it is essential to determine whether provision should be made for permanently waterproofing or dampproofing any part of the structure. If either is indicated, the designer must decide to what extent such protection is advisable and determine the means to be adopted for the purpose; or he may make certain provisions indeterminate, to be decided after the excavating has permitted a better examination of local conditions.

In the case under discussion here, of a school building in a semi-isolated location on a hillside in a small city, we find these specification clauses pertinent to the subject:

1. Integral waterproofing.
2. Damp courses.
3. Coating of outside basement walls.
4. Drain tile along footings.
5. Membrane waterproofing.

Regarding the first of these methods, it is interesting to note the diversity of opinion as to which of these integrants can be counted upon to function most efficiently:

(a) A diatomaceous or other magnesite or calcite earth or similar ingredient in powder form intended to be dumped into the mixer at same time as the cement.

(b) Slaked or hydrated lime.

(c) A waterproof admixture ground into the cement at the factory.

(d) A liquid waterproofing intended to be mixed with the gauging water.

On the general subject of such types of admixture, it is well to consider certain conclusions reached by the representatives of the Portland Cement Association as published in their "Concrete Data for Engineers and Architects": "Concrete made from properly selected aggregates, combined with Portland cement in suitable proportions, when thoroughly mixed to the right consistency, carefully placed and adequately protected during early hardening, will be watertight under all ordinary conditions."

As essential to the production of good concrete, the Association recommends clean, well graded aggregates, well mixed in proportion of 1:1½:3, with not more than six gallons of water per sack of cement, laid monolithically (or equivalent thereto), well spaded and kept warm and damp for ten days. Architects and engineers, however, continue to specify 1½ to 12 per cent (1½ to 12 pounds to each sack of cement) of admixtures, dependent upon their kind and the richness of the mix. This is done as much, perhaps, to improve the workability and flowability of the fluid mass as to guarantee its later water-repellant capacity.

The contention of the Association that well made concrete is practically waterproof is borne out in many instances. Experienced workers in this material, in localities such as the Missouri River valley, where the subsoil is yellow clay easily eroded, yet firm where undisturbed, do not hesitate to guarantee the watertightness of cisterns, the walls of which consist merely of from ¾ to 1 inch of cement mortar applied in successive coats, the first troweled directly on the clay and each applied with a strong arm.

The specifications for the work we are considering called for a certain integrant "or equal," somewhat to the embarrassment of the superintendent who was approached by several salesmen, each more or less insistent that his type of integrant was equal or superior to all others. Not being pressed for time, he refused to pass upon any of them but referred the subject to the architect who, in turn, declined to express a preference until the contractor himself decided what he wanted to use, which happened to be satisfactory and was duly approved. It was thereafter necessary for the superintendent to see that the concrete poured in outside basement walls contained the requisite admixture.

This was simplified by the fact that the contractor found that the integrant improved workability to a degree that made it economical to use the same mix for all basement pourings.

The specification for a damp course was sufficiently explicit to have prevented any excuse for one's going wrong with it; nevertheless the superintendent found the foreman instructing a laborer to cut the widths of heavy felt in two lengthwise to save material, thus making its width the same as the thickness of the wall. This was corrected, and the material laid its full width of 30 inches, so that the felt would project beyond the face of the wall, inside and out, to member with other waterproofing to be laid later, thus preventing exterior moisture making contact with the wall just above the footings. (See Fig. 10 in THE FORUM for July, 1929.)

Inasmuch as the soil carried a considerable moisture content, the coating of the outside surfaces of the exterior basement walls was specified as a precaution additional to the use of integrant in the concrete. In order to make such coating effective, it is essential that (1) a substance appropriate to the purpose be used; (2) that it be applied only to clean, dry surfaces; (3) that it effectually covers *all* areas with which earth is to come in contact; and (4) that it extends above grade at top, and down to and is well connected with the damp course lying on the footing shelf. In order to effect these conditions, it was necessary to do much cleaning of the outside of walls and uncovering of the felt, nearly all of which latter had been buried by falling earth. But thorough cleaning was insisted upon by the superintendent, who also made the workmen go over several places where the coating was defectively applied and put on a second coat. It is especially true of waterproofing and dampproofing that no work is better than its weakest part. If either is to be done at all, it must be well done or the whole cost is practically wasted.

The three methods described are inexpensive and effective under ordinary conditions, but each of the two latter can be improved upon, if thought advisable, by increasing the ply of the materials. Instead of a single thickness of heavy felt for the damp course, three or more plies of impregnated felt can be laid (tarred or asphalted), with thorough moppings between. This treatment can then be continued, as membrane waterproofing, over the outside wall areas below grade in place of the liquid application. This is much more expensive, because it is common practice to protect such membrane by from 2 to 4 inches of concrete or other masonry. Plastering it with cement mortar is not good procedure, because the weight of the mortar must be supported by the adhesion of the felt to the wall, and this may easily fail. "Parging" or plastering the wall with a mixture of cement and tar pitch, asphalt or other water repellant (without the membrane) is often resorted to and is probably more efficacious than the fluid application,—at somewhat increased cost. The chief essential, that there shall be no break in the coating, is, of course, best guaranteed by the membrane which should have greater elasticity than other solids, though pitch and asphalt, if of proper quality and consistency, will remain "alive" almost indefinitely when buried, and may re-seal minute fractures.

After examining the subsoil in the excavation, the architect decided that it was advisable to add assurance by installing a line of drain tile all around the outside wall footings. This had been forecasted by an alternative in the specifications, for which the contractor had, in his bid, named an extra of $380. This small cost affords an assurance of temporary protection against pressure of surface water on the walls when seeking an outlet. Owing to the eventual filling of the drains with silt and earth, the safeguard cannot be considered permanent, though the water may continue to run toward the sump in small channels, either inside or outside of the drains. So long as this lasts, there will also be a slight reduction in the upper pressure of moisture under the basement floor. The choking of the drains is partially guarded against by covering the upper half of the open joints (if farm drain tile is used) with pieces of tile, sheet metal or felt; or by the use of hub-joined tile. However, as these joints must be sufficiently open to permit ready seepage into the drain, it is obvious that sediment and roots cannot be entirely excluded. Knowing this, the superintendent saw that the tile were in good condition, properly placed on a natural earth bed, with proper fall, fairly close joints, well covered on top, and the trenches filled with broken stone or coarse gravel to the required height (See Fig. 10 already referred to); also that the sump was constructed as detailed, with proper connections in and out.

Thus was water or moisture that might percolate through the outer walls fairly well guarded against. There remained the possibility of infiltration through the basement floor. It was assumed that the footing drainage would serve to prevent this, except, perhaps, in the deeper section housing the boiler room. All basement floor slabs were, nevertheless, waterproofed integrally in the same manner as outside walls, and were laid on sand cushions which would absorb a moderate amount of moisture and slightly check its pressure. If the anticipated "head"

of water had been somewhat greater, or if in the basement there had been wood floors, which are particularly susceptible to the influence of dampness, something more positive would have had to be done. In such event (as where gymnasium floors are laid on the ground), it is often advisable to use membrane waterproofing or to lay hollow tile, with dry joints, under the concrete slab, which latter can then be reduced in thickness enough to compensate for part of the cost of the tile, as it need only be thick enough to afford secure anchorage for the floor sleepers or bedding for the wood blocks, as the case may be. Whatever is done in this particular, it is important that the protection shall be extended under the interior basement walls and partitions, if these are of concrete, brick or tile, to prevent capillarity. The protracted drying out of such masonry has been known to produce a vertical suction lasting through many months or even years, making it impossible to stop the staining by painting or by other usual methods.

The fifth method of waterproofing called for was for the membrane to be built into the floors and walls of the swimming pool. This served the dual purpose of keeping the ground water out and the tank water in, and was specified to consist of consecutive layers of impregnated felt containing a fabric, mopped under, over and between all layers, and with an added ply at all corners. This was covered with a flat layer of brick on the floor and 4-inch brick walls on the sides, on which the tile bed was laid in each case. This work was carefully done and supervised.

Waterproofing and dampproofing are more or less interchangeable terms and practices, though some authorities differentiate them by insisting that the former term be applied in all cases where the moisture exerts a pressure against the surface to be protected. Where this is the case, the method of waterproofing should be determined by an expert and should vary as the degree of pressure that is to be counteracted. Such designing is not a function of the superintendent, but he should so acquaint himself with current practice and local conditions as to be able to form an opinion as to the adequacy of what is provided for in the contract and to intelligently advise the architect, if called upon to do so.

A sixth method of waterproofing is sometimes used in tunnels, subways and other sub-aqueous construction,—more often where the method originally provided has failed in more or less degree. It consists in locating the leaks or "weepy" places on the inner surfaces of the defective walls and enlarging the places in such manner that the seepage throughout small areas can be directed to central points by means of porcelain tubing or otherwise. The surface around the tubing is then effectually waterproofed and the outlet tube later cut off and plugged; or, in some instances, where the pressure is too great to be thus repelled, the seepage is conducted by means of these built-in tubes or arteries to permanent drains, in similar manner to the draining of "weep" holes back of wall surfacing.

CHAPTER 12
FINISHED CONCRETE SURFACES

THE finishing of concrete surfaces falls naturally into two classes: (1) for wearing surfaces and, (2) for all other exposed areas. Each may be of character, composition, texture and color to suit the usage or purpose for which it is intended or to satisfy the idea of the designer. For the school building under discussion, we find a concrete base around the outside of the entire building, specified to be uncoated, but with all ridges and other inequalities left by the forms to be rubbed down (before the concrete has acquired its final set) with blocks of carborundum or of concrete of the same mixture as that called for in the walls. In order that such surfaces might come out as smooth as possible, the superintendent gave special attention to the operation of "spading" the flux; i. e., agitating the wet mix against the outside of the forms, as soon as deposited, with a flat tool (sometimes called a "straight hoe"), thus working the larger aggregate back and allowing the finer material to flow smoothly against the forms. This should prevent all pitting of the surface and produce planes as smooth as the boards of which the forms are constructed. Any carelessness in this spading will show plainly when the forms are removed and will necessitate patching of the surface. This is generally forecasted in the specifications by the stipulation that "immediately after the forms are removed, all rough places in the concrete shall be dressed off (or rubbed, as just explained), all bonding and tie-wires cut back from the surface, and all voids and pits filled in flush with 1:2 cement mortar, and all exposed surfaces left in smooth and acceptable condition."

Such a specification is, however, scarcely sufficient. Wall forms should be removed as soon as it is safe (in about two days in summer and four in cold weather), in order that the concrete may be finished while still green. Then, "the superintendent shall be given opportunity to

inspect the exposed surfaces. All damages due to improper mixtures, insufficient rodding, premature drying or other cause shall be made good by the Contractor to the satisfaction of the Architect. All pits, spalls and loose aggregate shall be picked out and cleaned as directed, grouted and smoothly patched as specified."

This work should be done most carefully, else the patches will show, perhaps bond poorly, and later freeze off. To prevent this, the walls should be kept moist (as is elsewhere specified) and the places to be patched treated with rich grout or bonding cement. All such patches should be attended to most promptly in order that they may acquire initial set in time to be rubbed at the same time as adjoining surfaces. Workers who are adept finishers will produce walls that need no patching, and hence can use sand floats on the wet surfaces a day sooner than when waiting for patches to set. Done with fine sand and plenty of water, this method is quite as effective as that done with blocks. It lies with the superintendent to determine when such treatment, by either method, has been carried on long enough for the intended degree of smoothness.

Other methods of surface treatment are by various kinds of hand or machine tooling, as for cut stone, or by sand blasting with compressed air and fine sand. Specimen areas are, in such cases, submitted for approval, and the superintendent must be the judge of whether all areas so treated match the approved sample. There appears to be an increasing use of monolithic surfaces as just described, many architects even leaving the concrete entirely untouched, after the forms are removed. When this course is intended to be taken, one must make sure that the form work is in exact shape to produce the desired results, especially that the lines of demarcation between successive pourings do not appear in undesirable places. Sometimes false joints are called for, and strips are nailed inside of the forms to produce such an effect. All construction joints should then be made to occur at these strips and thus rendered invisible in the finished work. This is really imitation stone, not often called for. Such design is more frequently executed in pre-cast blocks.

Although the use of exposed concrete surfaces is apparently increasing, there are still many designers who specify the application of cement plaster or stucco to the rough concrete, especially if some unusual color or texture is sought. This is properly applied in three coats to a total thickness of not less than ¾ inch, "the first two coats to be composed of one part Portland cement (to which has been added 10 per cent of hydrated lime) and 3 parts of well graded clean sand. All surfaces to be plastered shall be thoroughly cleaned, picked free of loose aggregate, well brushed, drenched with clean water and dashed with 1:1½ 'soupy' cement grout, which shall be allowed to thoroughly set before plastering. The surfaces shall then be well moistened and the first coat troweled on hard and tight and well scored. This shall be kept moist 24 hours, then allowed seven days for drying, then moistened and the second coat applied, rodded straight and true in every direction. The third coat shall be an approved make of exterior stucco, from ⅛ inch to ¼ inch thick, well troweled on and finished like an approved sample."

The chief objection to exterior plastering on concrete is the prerequisite of extreme care and expert workmanship, lacking which the finished material may soon show fine cracks and eventually spall off. This is especially true where it is subjected to freezing conditions. Since exterior stucco is chiefly used as a cheap covering for tile walls and their imitation done in lath and studding, it would appear to be wasted in the disguise of more permanent construction. However, when he finds stucco designated, it is not a function of the superintendent to reason why, but to see merely that it is up to specification requirements, properly mixed and correctly applied to properly prepared surfaces.

Ornament and run-moulds are frequently used in connection with exterior plastering and need very close supervision, whether pre-cast or worked in place. Ornament cast in place demands the most careful manipulation of the flux in the forms, use of all coarser aggregate being entirely eliminated. The "waste moulds," in which the actual ornament is formed, are first submitted for approval, and hence one is thereafter concerned only in the mechanical process of filling the forms. The sheet-steel templates, used by plasterers in running mouldings, should also be submitted to the superintendent and compared with full-sized profiles on detail drawings.

Floor and paving slabs intended to have a finish coat of cement mortar (ordinarily called "cement finish") are variously specified but, more often than not, it is sought to have the surface made monolithic with the slab by demanding that the top coat or "topping" be laid "before the concrete has had time to set," then floated or troweled as required. With slabs laid on the ground, or with roof slabs above which there is no further construction work, such a process is not difficult. But it is quite impracticable to lay monolithic topping on intermediate slabs over which the workmen must proceed with the form work for the floor construction next above. For such floor finish and for terrazzo and other finish materials laid in cement mortar, a special proviso must therefore be incorporated in the specifica-

tions, to the effect that "the slab shall (if so directed by the Superintendent) be rough-picked and cleaned by means of water and steel brushes and kept thoroughly wet with clean water for six hours before laying topping. All such contact surfaces (rough, clean and wet, but without free water) shall be thoroughly covered with a thin coat of neat cement grout, applied shortly before the topping is deposited."

The need of exercising every precaution to insure a good bond between the topping and the slab cannot be exaggerated. Imperfect bond and improper troweling of the surface are the most prevalent faults of concrete floor finishes. Troweling is work for experts only. These know just when the quaking surface is right for attack, and proceed accordingly, regardless of when the whistle blows. Specifications should take cognizance of this and provide that "overtime labor shall be provided by the Contractor, without extra charge, whenever necessary to properly complete such unfinished areas." If there is any slip-up on this, the superintendent should act promptly and should have the entire topping removed before it sets, rather than allow it to harden without correct finishing. Some concrete finishers like to hasten the absorbing of surface water (which should have disappeared before troweling is begun) by dusting neat cement into it and troweling at once. This is forbidden in better specifications, as is the troweling in of the laitance. Either might be the cause of dusty wearing surfaces. It is frequently better to save troweling (and even topping) by specifying that it be omitted in all unfinished or unused areas, such as pipe spaces, dead storage areas, tunnels, cheap cellars, etc., providing merely that the surface of the slab be evenly floated to exact plane level with screeds. Such surfaces can even be troweled by one who knows how. Excellent sidewalks and railway platforms have been constructed in this manner. Concrete paving is generally left "under the float," the rough surface being better than the smooth.

The thickness of topping varies from a ¼-inch skim coat under roofing and other waterproofing to 2-inch or even 3-inch, depending upon design and other conditions. A ½-inch coat would be ample in all cases, if one could be sure of getting the monolithic bond called for; but one is so uncertain of this, so sure that there will be places where it can't be done, that a minimum of ¾-inch is the rule, a 1-inch topping being most commonly specified. However, if one is guarding against bond failure, the 1-inch thickness is not enough better than ¾-inch, and hence in better class work, architects and engineers allow from 2-inch to 3-inch for the finish on top of reinforced slabs. This simplifies construction in many ways, even permitting the running of conduits on top of slabs. Thus 2½-inch was the allowance above slabs in this school building in the entrances, corridors and toilet rooms and in the laboratories in the third story. Elsewhere, above the basement, the allowance was 1-inch, just sufficient for the laying of wood block flooring in mastic. If use of ordinary flooring, laid on sleepers, had been contemplated, the 2½-inch allowance throughout would have been a still more straightforward method. This is about right also for laying of tile, marble or terrazzo. It means a dead load of 30 pounds per square foot where these materials or concrete topping are used, though this can be reduced about 10 pounds by the use of cinder concrete for the bed. In any case, the bed and topping must be laid practically simultaneously or nothing is gained by having increased the thickness above the slab. Further precaution was provided against cracking of these school house floors by the insertion of light-weight wire mesh in the concrete bed. (See Chapter 10.)

Terrazzo, as used for floor finish, is a high grade concrete in which the coarse aggregates are colored marbles, selected to produce an intended design or color scheme, at times worked into beautiful mosaics. Naturally, it has a wide range in price, depending upon the kinds of marble used, the patterns in which it is laid, the amount of brass dividing strip used, and (because of the transportation of men and special equipment) the total square footage required. Good terrazzo can be produced at moderate cost by the use of cheap domestic marbles and is greatly to be preferred to the ordinary cement-mortar topping, because of its appearance and its greater cleanliness. Perhaps the chief trouble with terrazzo at the present time is a lack of uniformity in architects' specifications for the material as well as in those of the producers themselves.

"For instance, one manufacturer's specification calls for the surface of structural slab to finish 3 inches below plane of finished floor. On this is laid ¼ inch of sand and a thickness of tar paper, obviously to keep the sand from combining with the underbed of the terrazzo. Thus we have an effectual cut-off that should prevent the transmission of cracks in the structural slab through the finished floor resting on it; 2 inches of underbed (1:4 cement mortar) is laid on the tar paper and the ¾ inch of terrazzo deposited thereon and made monolithic therewith.

"Another manufacturer issues a detail of the same kind of construction and formerly recommended a specification to fit the detail, but has since changed it to read: 'A properly concreted floof, finished to within 1½ inches of the fin-

ished level, shall be provided under another contract.' Upon this he lays ⅞ inch of screed coat and ⅝ inch of terrazzo and makes no mention whatever of a sand cushion. Still another calls for 2 inches of 'sublayer' and ½ inch of finished terrazzo. So we have the finish varying from ½ inch to ¾ inch in thickness and the underbed from ⅞ inch to 2 inches, either cemented to the structural slab or separated from it. Evidently, neither is perfect nor crack-proof. The best reliance seems to be upon the brass strips. If cracks must be, let them be where they will be the least noticeable.

"The National Terrazzo and Mosaic Contractors' Association (headquarters in Milwaukee), has recently adopted what is intended to be a standard terrazzo specification which calls for a ¾-inch terrazzo mixture on 1¼ inches to 2¼ inches of concrete bed, the latter to be cemented to the under slab with cement grout (or, on wood sub-floor, to be deposited on waterproof paper). To what degree this specification will be generally used remains to be seen. The surface on which the 'underbed' is to be deposited should be swept clean and drenched, as otherwise it is likely to suck the moisture out of the concrete and leave it granulated. If it is deemed advisable to have the terrazzo slab adhere to the structural, a bonding cement should be used. If there is no adherence and if there are places where the terrazzo is thinner than intended (due to inequalities in the structural slab), it may later separate enough to give forth a hollow sound under foot and eventually break. It is up to the superintendent to *know* his terrazzo."*

It should be borne in mind by the designer who likes to create patterns with the brass strips that their chief purpose is not to prevent cracking but to render the cracks as nearly invisible as possible. Inasmuch as cracks in structural slabs (which are the chief cracks to be guarded against) are to be looked for parallel to the direction of structural members and at right angles to them, it is obvious that these are the directions in which the strips should run. If laid in diagonals or arcs, they serve only as pattern members and, if cracks occur, they will ignore such strips and be plainly discernible.

In this school, terrazzo was called for in the vestibules and entrance lobbies (for floor field, border and base), in the bathrooms, locker rooms and toilet rooms (for field only, tile being used for base and wainscot and in the pool), for border and base in the corridors above the basement; and for field and base in basement corridors. Above the basement rubber tiling was used for runways in corridors. Fillers 1½ inches thick in all stair treads and platforms were of terrazzo between the first and second stories and of cement mortar elsewhere. In all cases, both the terrazzo and cement-mortar filler contained a non-slip aggregate, which was also specified for the floors of bathrooms and areas surrounding the pool. This is dusted into the topping, one to two pounds to the square yard, and the superintendent must see to its uniform distribution prior to the troweling. If incorporated in the original mix, a much larger quantity is required.

Various methods are in vogue for improving the surface and wearing "life" of concrete floors, such as using "hardeners" to be mixed with the aggregates, added to the gauging water or dusted into the surface. Whichever is specified, the superintendent must familiarize himself with the maker's requirements and know that they are being carried out. If such work is done by others than the producer's own trained men, he may have to supervise the education of the contractor's employes in order to secure satisfactory results. Again must he guard against assuming too great responsibility in such procedure. He must make sure that all responsibility rests on the contractor, both as to all construction work of every description that is to be covered by floor surfacing and as to its suitability to receive the kind of material that is to be laid thereon. This is especially true of proprietary brands of surfacing, such as the various types of so-called "sanitary" flooring. Owing to the many failures of such topping, it is seldom incorporated in an architect's specification, except to be laid by the maker's own men and methods and under a most rigid guaranty. Even so, there is laid on the superintendent the customary obligation to know as best he may that the owner is getting what he is paying for; that surfaces are even as to texture, tints and planes; and, if the same material is used for base, that all lines and arrises are true and that cove and top are truly formed.

Our superintendent was fortunate in securing excellent coöperation from the contractor's general foreman, but he found that, as usual, he had to keep constant watch over sub-foremen and their men, many of whom were ever ready with the excuse that they "had always done it that way and that no one had told them that this job was any different" One such was heard to say: "No matter what I do on this job, when I look at the specifications, I find it ought to have been done some other way" On any work that is intended to be just a little better than the average, this is quite likely to be true, and hence the importance of a man's familiarizing himself with the specifications is impressed upon everyone having to do therewith.

*Quoted from "Specifications for a Hospital", by W. W. Beach Pencil Points Press, New York, 1929.

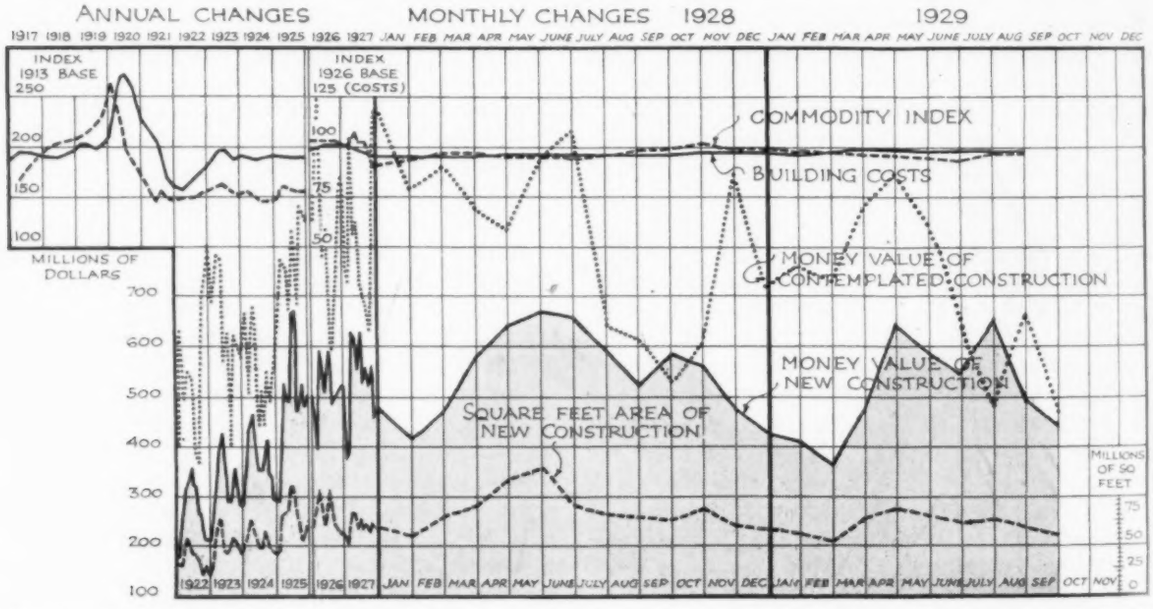
THE BUILDING SITUATION

A MONTHLY REVIEW OF COSTS AND CONDITIONS

CONTRACTS awarded for September construction, amounting to $445,402,300 in the 37 states east of the Rocky Mountains, show a decline of 9 per cent from the value of contracts awarded during August, and 24 per cent from that of September a year ago, according to the F. W. Dodge Corporation. While at first glance this would seem to indicate that September construction was far below normal, it should be borne in mind that the normal construction year shows a seasonal falling off of around 6 per cent between August and September. In view of this, the decline of 9 per cent for this past September is not extreme. The unusual falling off of 24 per cent from figures for September, 1928 is largely accounted for by the abnormal increase which took place in 1928, which was just the reverse of the normal seasonal trend. Contracts awarded for the first nine months of 1929 amounted to $4,602,267,600, having fallen off approximately 10 per cent from the figures for the first nine months of 1928. In the district comprising New York state and northern New Jersey, September contracts amounted in value to $81,222,500, which is 14 per cent under the August figure and a decline of 48 per cent from that of September a year ago. For the first nine months of this year the contracts awarded in this district amounted in value to $1,083,134,200, a decline of 20 per cent from figures for the same period of 1928. In the New England states work totaling $34,297,700 was started in September. This was 3 per cent ahead of the August contracts, but 52 per cent behind September of last year. For the first nine months 1929 showed a total of $318,247,800.

In the middle Atlantic states, September construction, with a total value of $48,822,200, was 7 per cent ahead of August, but 25 per cent below September, 1928. For the three quarters ending with September, the construction started amounted to $557,215,900 and represents a falling off of 8 per cent from the first nine months of last year.

While the total construction for the first nine months of 1929 is still 10 per cent below the 1928 figures for a corresponding period, it is interesting to note that as the year progresses each quarter makes a better showing than that preceding. At the end of the first quarter, for instance, 1929 construction was running 16 per cent behind that of 1928. For the second quarter, 1929 was only 9 per cent behind, and now the third quarter is only 6 per cent below the third quarter of the last year.


ANNUAL CHANGES
MONTHLY CHANGES 1928
1929
1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927
JAN FEB MAR APR MAY JUNE JULY AUG SEP OCT NOV DEC
INDEX 1913 BASE
INDEX 1926 BASE 125 (COSTS)
COMMODITY INDEX
BUILDING COSTS
MONEY VALUE OF CONTEMPLATED CONSTRUCTION
MONEY VALUE OF NEW CONSTRUCTION
SQUARE FEET AREA OF NEW CONSTRUCTION
MILLIONS OF DOLLARS
MILLIONS OF SQ FEET

THESE various important factors of change in the building situation are recorded in the chart given here: (1) *Building Costs.* This includes the cost of labor and materials; the index point is a composite of all available reports in basic materials and labor costs under national averages. (2) *Commodity Index.* Index figure determined by the United States Department of Labor. (3) *Money Value of Contemplated Construction.* Values of building for which plans have been filed based on reports of the United States Chamber of Commerce, F. W. Dodge Corp. and *Engineering News-Record.* (4) *Money Value of New Construction.* Total valuation of all contracts actually let. The dollar scale is at the left of the chart in millions. (5) *Square Foot Area of New Construction.* The measured volume of new buildings. The square foot measure is at the right of the chart. The variation of distances between the value and volume lines represents a square foot cost which is determined, first by the trend of building costs, and second, by the quality of construction.